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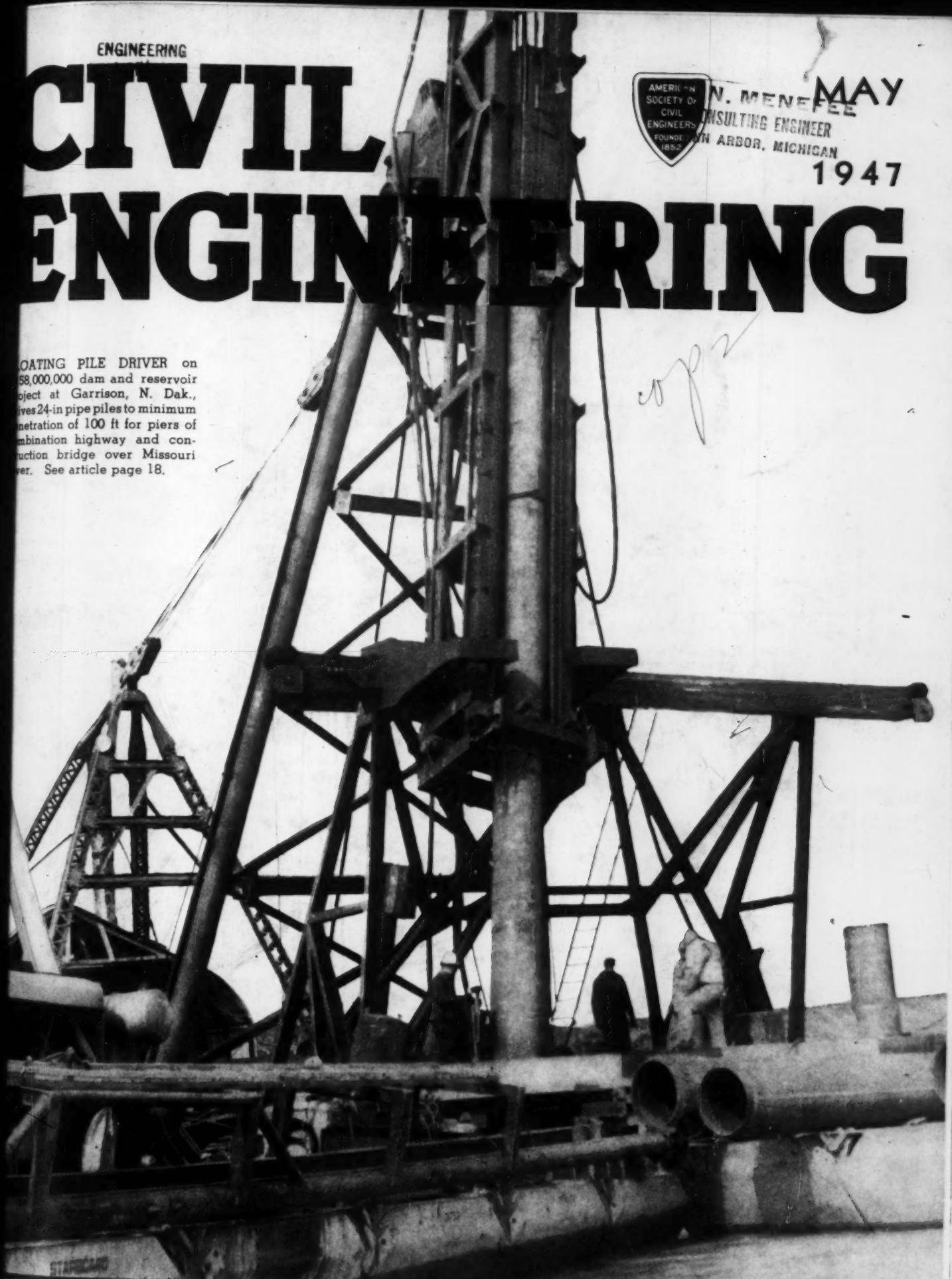

LOATING PILE DRIVER on $58,000,000 dam and reservoir oject at Garrison, N. Dak., ives 24-in pipe piles to minimum netration of 100 ft for piers of mbination highway and con- uction bridge over Missouri er. See article page 18.

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Second San Francisco Bay Bridge Proposed at Estimated Cost of $99,300,000
New Construction Technique Reduces Cost of Large-Scale Housing in New York
Construction of Adequate Parkway System in Los Angeles Area is Essential
Modern Airport Design Depends on Technical Skill of Engineer

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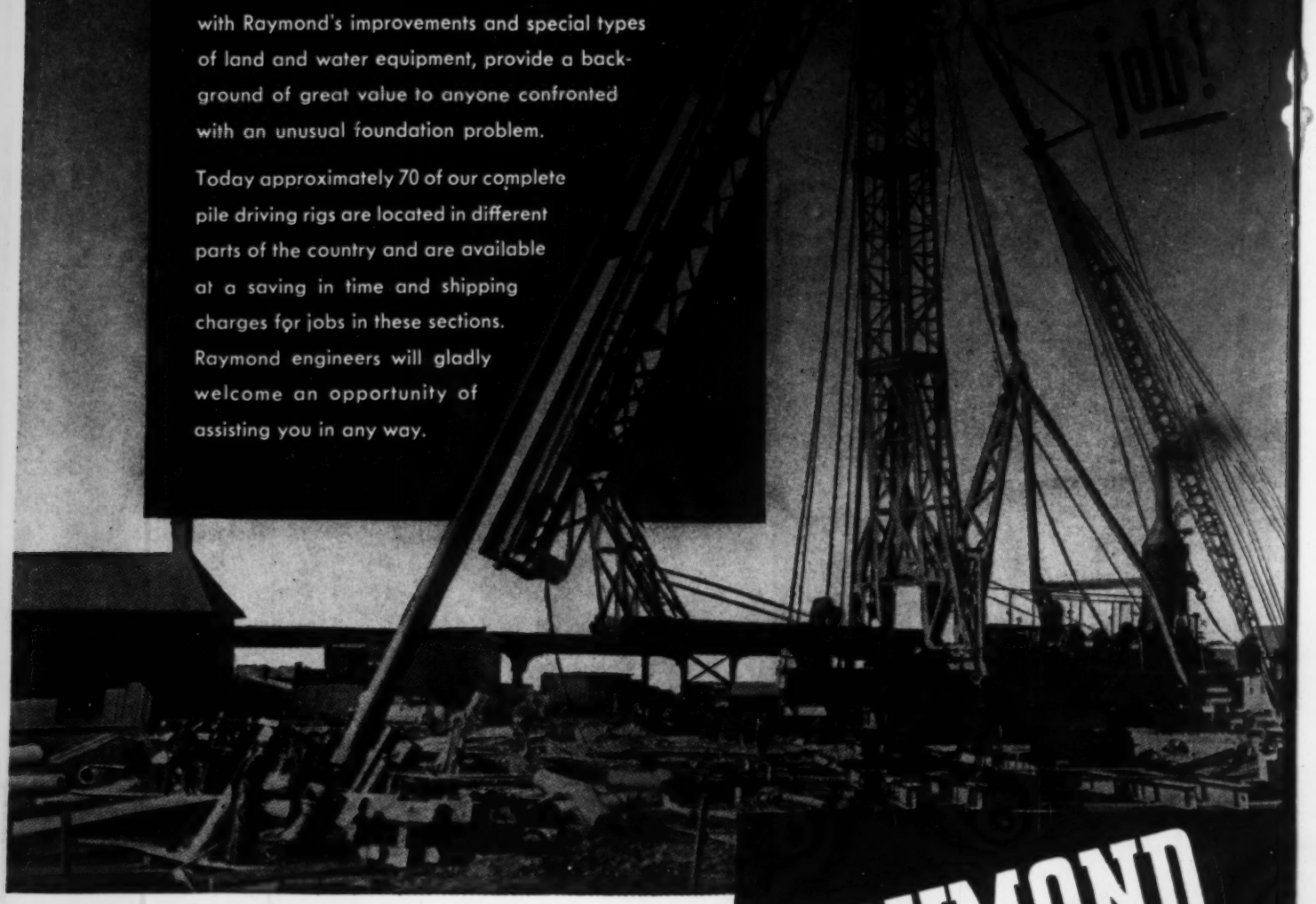

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Volume 17 Number 5

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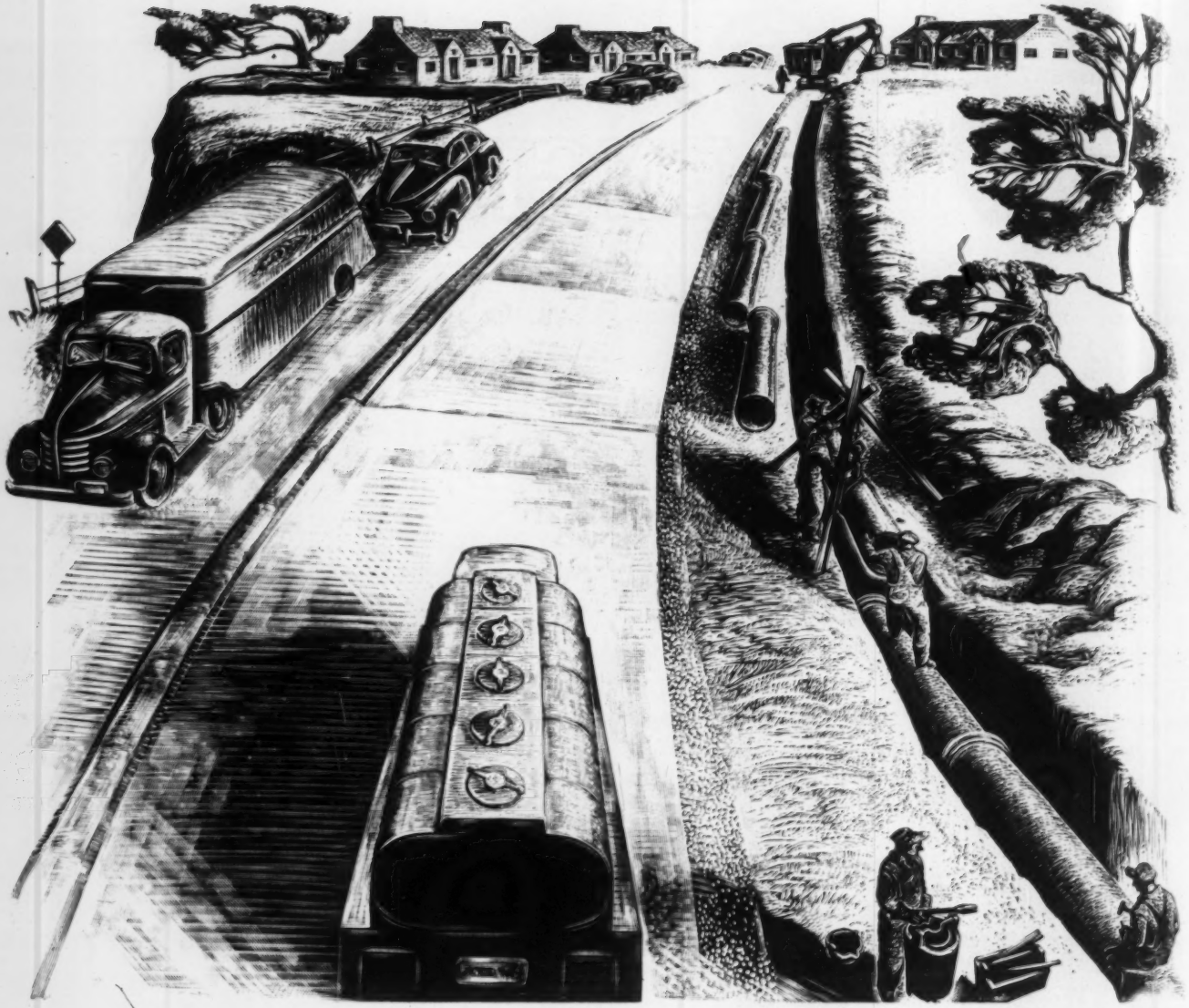

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Irrigation and Power Subjects Keynote ASCE Spring Meeting at Phoenix

Eight Technical Divisions Present Papers

DEVELOPMENT OF RESOURCES in the Southwest, with particular reference to the Colorado River and its potential for irrigation and power, highlighted technical discussions at the ASCE Spring Meeting in Phoenix, Ariz., April 23 and 24.

Sessions of eight Technical Divisions occupied a day and a half of the three-day meeting. Papers were presented and discussed at meetings of the Highway, Irrigation and Surveying and Mapping Divisions on Wednesday, April 23. Five Divisions —Air Transport, Power, Sanitary Engineering, Hydraulics, and Construction—had interesting sessions on Thursday. Subjects treated at these sessions are reported in the following Division write-ups.

Colorado River Development Papers Are Highlights of Irrigation Division Session

UNLESS CONGRESS passes a bill now before it authorizing construction of the Bridge Canyon project diverting 1,200,000 acre-ft of water annually from the Colorado River into Central Arizona, that region faces economic hardship that may ultimately compel it to abandon 200,000 acres of fertile land to the desert from which its residents have wrested it over the last 80 years.

This fact was the basis of a paper presented by Charles A. Carson, Phoenix attorney, before the Irrigation Division session, over which R. V. Leeson, Assistant Engineer, Maricopa County Municipal Water Conservation District No. 1, Phoenix, presided.

"With water we live and prosper; without water we die," Mr. Carson declared regarding the essentiality of irrigation in Arizona. He stressed the fact that "we are not asking for grants from the federal treasury. All of the costs except those allocated to flood control and similar purposes, which customarily are made non-reimbursable, will be repaid directly to the federal treasury through charges for electric energy and charges for the delivery of water."

Mr. Carson described the Central Arizona area which will be affected by the pending legislation as containing 725,000 productive acres wholly dependent on irrigation water, and its 400,000 residents as being "dependent for a living directly or indirectly on the continued prosperity of this agriculture." His description of the project for bringing main-stream Colorado River water into Central Arizona was as follows:

"It is planned to build a dam in the main stream at Bridge Canyon and to build an aqueduct from Lake Havasu to Granite Reef Dam on the Salt River and a canal from the Salt River to the Gila River in the vicinity of the town of Florence in Pinal County, and a canal from the Gila River to the Picacho Reservoir and the Santa Cruz flood plain. It is further planned, at some future time when conditions justify it, to build a tunnel and aqueduct from the reservoir which will be created by Bridge Canyon Dam to a junction with the Lake Havasu aqueduct near Cunningham, Wash., so that water may flow into Central Arizona by gravity.

"It is further planned to effect exchanges of water by supplying main-stream water to lands on the lower reaches of the Salt River and Gila River in order to release tributary water for use upon lands upstream, so that all the lands now irrigated in Central Arizona may be assured of an adequate water supply by use of Colorado River water to supplement their present supply, and so that over-pumping will be avoided and disaster averted."

He hailed the bill pending before Congress as a sound investment and declared that "no other projects anywhere can be found which are so closely in the national interest."

Julian Hinds, general manager and chief engineer, Metropolitan Water District of Southern California, was author of a second paper, "Pumping-Plant Design for the Colorado Aqueduct." This paper discussed the pumping plants for the Colorado River Aqueduct constructed to supply water for most of the principal cities of Southern California from Santa Monica south to the cities comprising the San Diego County Water Authority.

The paper described the problems encountered in preparing to lift the tremendous amount of water a total of 1,617 ft in five separate lifts distributed over the first 126 miles of the aqueduct, and pointed out that a wide divergence of opinion existed among pump manufacturers as to the best type of pump to be used.

A complete pump-testing laboratory was constructed and equipped by the District at the California Institute of Technology, and consultants were retained from the Institute faculty. The testing facilities were of sufficient capacity to investigate the performance of pumps having dimensions about one-fifth of the estimated dimensions of the proposed full-size pumps, the paper stated.

As a result of the tests, which cost approximately $150,000, there was a "consequent saving in space, foundation work, and pump costs amounting to not less than $750,000."

"Administrative Control of Ground Water and Its Economic Effect" was the title of a third paper, by Harold Conkling, Los Angeles consulting engineer.

Trebling of Colorado Power Held Possible

COLORADO RIVER RESOURCES, already responsible for crop-producing irrigation on land that previously was desert, and for fast-growing cities which owe their growth to its life-giving water, despite the fact that they are hundreds of miles from the stream, have barely been tapped.

This was emphasized before the Power Division in a paper by H. F. McPhail, Washington, D.C., Director, Branch of Power Utilization, Bureau of Reclamation. His was one of two papers presented at the Division meeting, over which Walter Dreyer, San Francisco, member of the

Division's executive committee, presided.

The Colorado's power possibilities alone are such that the the presently developed capacity, large as it seems in comparison with early-day evaluations of potentialities, can be more than trebled, it was brought out by Mr. McPhail's paper, "The Colorado River—Past and Future."

The paper drew a sharp contrast between present thinking regarding the Colorado River basin and the first survey of it in 1857, quoting the following from the report of an Army Lieutenant to the War Department:

"The region . . . is, of course, altogether valueless. It can be approached only from the south, and after entering it, there is nothing to do but leave. Ours was the first, and doubtless will be the last, party of whites to visit this profitless locality. It seems intended by Nature that the Colorado River along the greater portion of its lone and majestic way shall be forever unvisited and unmolested."

In his paper, Mr. McPhail stated that the region's power possibilities, less than one-third developed, are only one factor in the evidence of how inaccurate, though lyrical, the foregoing evaluation was. After describing how the multi-purpose structures along the Colorado provide flood control, silt control, irrigation and domestic water storage and important recreational facilities, in addition to power production, the paper declared:

"For the entire Colorado River drainage area we have a future possibility of more than 3,600,000 kw of additional capacity, and nearly 20 billion kwhr as compared with present development in or under construction of about 1,500,000 kw, and 7.2 billion kwhr of annual production."

"Arizona Power Requirements" was the title of the second paper, prepared by John T. Kimball, Assistant to the President, Central Arizona Light and Power Co., Phoenix.

Progress in Studies of Reservoir Sedimentation Holds Attention of Hydraulics Division

PROGRESS IN the civil engineering profession's contribution toward solution of one of the West's costliest problems—sedimentation in reservoirs—was reported at the Hydraulics Division meeting, at which W. H. Nalder, Denver, a member of the Division's executive committee, presided.

Three papers were devoted to various phases of the work being done by a joint committee on sedimentation representing the Society's Irrigation, Power, Sanitary Engineering and Waterways Divisions, in addition to the Hydraulics Division.

In his paper, "Economic Effects of Reservoir Sedimentation," William E. Corfitzen, U.S. Bureau of Reclamation, Washington, D.C., called the sedimentation problem "one of national importance," pointing out that reservoirs rendered useless by sedimentation affect not only economic welfare of citizens nearby, but the taxes which all the people pay.

"Studies have indicated that one farm family on an irrigated area supports four additional families on that and surrounding areas. Consequently as the irrigation pool is depleted, there naturally would follow a decrease in agricultural production, with attendant decline in income to the farm family and each dependent family. The land values of agricultural and nearby urban properties would decline. During the years when storage is being lost there exists the danger that farmers, who have made substantial investments in their lands, will plant crops beyond the availability of water to sustain growth. Consequent crop failures could be tremendous and might conceivably lead to relocating populations in other areas."

Similarly, the paper pointed out, sedimentation effects on reservoirs used for storage of water for power and municipal water supply purposes can "result in loss of revenue to individuals and industries and may even result in the physical relocation of industries in other areas."

The problem of sedimentation of reservoirs is not a new one, the paper stated, citing the Bureau of Reclamation's bitter experience with Laguna Dam on the Colorado, completed in 1909, to show the speed with which the sedimentation menace can operate.

"This dam, costing $1,921,000," Mr. Corfitzen recalled, "was 13 ft high, 4,844 ft long, and raised the water surface 10 ft. Water was backed up about 10 miles. In less than a year, the basin created by this dam had been filled with sediment."

In narrating the work being done by the American Society of Civil Engineers' joint committee studying this problem, the paper declared:

"The economic life of a reservoir will depend on a number of factors, one important factor being the nature of the use or uses of the impounded water, together with the relationship between such uses and the accumulating silt. While we have not had time to analyze an actual problem, it is proposed to select one or more of the larger reservoirs of the country where some data are available covering many years of operation and to prepare a detailed analysis involving all the uses.

Such a study should embrace these points: (1) Established use pattern of reservoir and economic life without further controls; (2) determination of possible controls, their costs, their effectiveness, and their economic justification; and (3) determination of cost of reservoir to replace existing reservoir."

D. C. Bondurant, U.S. Engineer Office, Albuquerque, N.Mex., had a paper on "Sedimentation Investigations at Conchas Reservoir," and J. W. Stanley, River Control Office, Bureau of Reclamation, Boulder City, Nev., had one on "Retrogression and Its Effect on the Colorado River After Construction of Boulder Dam."

Highway Division Papers Stress Economic and Design Phases of Construction

ECONOMIC, AS WELL AS DESIGN, aspects of highways, both in states and in cities, were discussed in three papers prepared for presentation at the Highway Division session, over which G. L. McLane, District Engineer, U.S. Public Roads Administration, Phoenix, presided.

Necessity for "tailor-made" pavements to meet climatic, traffic and subsoil conditions in each particular instance, was emphasized in the paper of Donald J. Steele, Senior Highway Engineer, U. S. Public Roads Administration, San Francisco. His paper reported some progress in formulizing types of pavement surfaces and subsurfaces, but emphasized that the selection of types and thicknesses of both should be governed by

the volume and weight of traffic to be carried, and warned that "the many variations of the problem may introduce more confusion than clarification."

According to Mr. Steele, "Certain roads in service can be picked out as examples in support of various schools of thought regarding adequate and economical pavement design, but wide differences in quality and thickness of substructure layers used under comparable conditions make it clear that research is needed to furnish a convincing answer to this question.

The major steps taken during the past 20 years in efforts to correct deficiencies in performance of concrete pavement have been to increase thicknesses of slabs and in some cases to add reinforcement and heavier dowel assemblies. After getting thicknesses up to as high as 10 in. of reinforced concrete and finding this still deficient when placed on fine-grained soils, the final step has been to provide heavy base courses of coarse granular materials. If substantial base courses had been adopted as the first step, rather than the last, then there would be more evidence on which to form reliable conclusions. The available evidence indicates that the greatest single cause of pavement failures in the past has been lack of adequate substructure."

The paper emphasized, regarding the last statement, however, that this evidence still is inconclusive, and advised each engineer to "check any proposed methods against actual road performance in his locality and thus arrive at desirable adjustments."

A second paper, by E. V. Miller, Phoenix, Chief, Division of Plans, Arizona State Highway Department, stressed the fact that state highways and their improvements must be economically justified, a part of the economic structure of the state, and receive priorities consistent with anticipated revenues.

"If the revenues derived from the highway system are an economic benefit, then highway expenditures should be correlated therewith," it held in outlining Arizona's postwar program of improving the state's 2,458 miles of primary highway system. The paper pointed out that more than half—1,470 miles—of the system already is obsolete, owing to increased traffic and the fact that the prewar highways were built by "budgeting of a shot-gun method" and "obviously to appease pressure groups who demanded that counties or districts receive their proportionate division of road funds," and emphasized the need for avoiding repetitions of earlier mistakes in planning new roads and improvements.

The Arizona Planning Survey is making a thorough study to arrive at a sufficiency rating for each highway, designed to provide breakdowns revealing even spot locations of deficiencies, it was brought out.

"This study," Mr. Miller pointed out, "rates each highway or portion thereof, using factors of design, such as width, curvature, sight distance, surface type, surface condition and marginal influence, all in relation to traffic volume and speeds. Other factors, such as sufficiency of base, sufficiency of surface, accidents, speed and delay and right-of-way widths may be included in future studies."

Lloyd Aldrich, City Engineer, Bureau of Engineering, Los Angeles, was author of a third paper which depicted freeways and parkways, not as the financially-out-of-the-question structures of some dim, distant future day, but as already being here and accommodating swollen postwar traffic so safely and economically that they are saving lives and money. Mr. Aldrich's paper is presented in this issue of CIVIL ENGINEERING, page 28.

Improved Aggregate Testing Should Accompany Concrete Studies, Construction Division Told

IMPROVED TESTING OF AGGREGATES should be carried on hand in hand with research to improve cement and techniques of mixing, placing and curing to realize the full potentialities of concrete, it was brought out in one of three papers before the Construction Division meeting, at which Retired Admiral Kirby Smith, Raymond Concrete Pile Co., New York, the Division's executive committee chairman, presided.

R. F. Blanks, Chief, Engineering and Geological Control and Research Division, U.S. Bureau of Reclamation, Denver, was the author of the paper which pointed out:

"The primary diffiulty with present aggregate testing lies in the concept that strong and durable rocks necessarily contribute to strength and durability in concrete, and conversely, that weak rocks directly contribute to unsoundness of concrete. Our standard tests are designed to determine the quality of aggregate as rock, not as a component of concrete."

Detailing how various tests inquire into the characteristics and "ancestry" of rocks, the paper went on to state that "experience shows that good rocks do not always contribute to superior qualities of concrete, and weak rocks do not always cause deterioration."

The paper described a research project now nearing completion in the Reclamation Bureau's laboratories which has evolved a quick chemical procedure capable of distinguishing deleteriously reactive from innocuous aggregates. The procedure can be completed in two days, and provides a great degree of insurance against misbehavior of aggregate rock when in company with the other ingredients of a batch of concrete, as well as against resulting failure of the concrete.

Captain A. K. Fogg of the Naval operation base at San Diego, was author of a second paper describing how engineers are racing to meet the water demands of San Diego, the war-swollen population of which is 21 years ahead of prewar estimates and bids fair to remain that high despite the war's end.

After describing the San Diego Aqueduct—a project entailing procurement of water from the Colorado River—the paper stated:

"Apparently the war-gained population is there to stay, and it was fortunate indeed for the City of San Diego and for the war effort that the city entered the war period with well-filled reservoirs and that above-average rainfalls occurred.

Six consecutive years of above-average rainfalls had never before occurred since rainfall records were started in this area. Despite this favorable condition, the draft has been in excess of makeup, so that only about one year's supply now remains in the reservoirs."

A postwar rarity, an ahead-of-schedule construction project, was described in the third paper, "Construction of Davis Dam," by L. R. Douglass, Assistant Regional Director, Region 3, Bureau of Reclamation, Boulder City, Nev. The dam, named in honor of the late Arthur Powell Davis, Past-President of ASCE, was described as the last in a series—Boulder, Parker, Headgate Rock, Imperial, Laguna—begun 40 years ago. Now under construction by the Bureau of Reclamation 34 miles west of

Kingman, Ariz., and 67 miles below Boulder Dam, the dam is well ahead of the construction schedule.

Its purposes are "reregulation of Boulder Dam power discharges, servicing of the recently negotiated Mexican treaty, and utilization of the last available site for substantial power development on the main river below Boulder Dam."

Sanitary Engineers Urged for Administrative as Well as Technical Positions

ESTABLISHMENT OF SANITARY ENGINEERS in administrative as well as technical positions in state boards of health, as a wartaught means of safeguarding the nation's growing health program, was advocated in one of three papers presented before the Sanitary Engineering Division. R. F. Goudey, Los Angeles, member of the Division's executive committee, presided.

George W. Marx, Director, Division of Sanitary Engineering, Arizona State Department of Health, was the speaker who urged the Society and individual members to press for peacetime retention of the professional prestige fostered by the lifesaving contributions of sanitary engineers to the war effort.

Mr. Marx pointed out the sanitary engineer's essentiality in sewerage and sewage disposal, industrial waste treatment or disposal, garbage and refuse collection and disposal, rodent and insect control, milk and food sanitation, industrial sanitation, and housing sanitation, and declared:

"The war has taught us the value of preventive medicine, and sanitation has been emphasized as extremely important in such programs. The nation is health conscious and there is an expansion program in public health going on throughout the country, as well as in other countries. This sudden interest in public health has depleted the available source of well-trained professional public health personnel. There is today a potential need of approximately 1,000 sanitary engineers trained in public health, which represents both a danger and an opportunity to the profession of sanitary engineering.

"The danger lies in the possibility of the lowering of standards of qualifications in an attempt to fill vacant positions. This would indeed be unfortunate, since the sanitary engineer in public health has not yet attained the prestige he deserves.

"The engineering profession should synchronize with this personnel shortage a more positive interest in the administrative affairs of the departments of health. We have been guilty of being too content to do the work as it presents itself and to take little leadership in the administrative activities of the health agencies in which we operate. We must assume and maintain our rightful position of administrative, as well as technical, leadership and develop a career service for the sanitary engineer in public health.

"We should insist upon high standards of qualification and define and clarify our professional status as engineers and the sanitation administrative problems which have usually been determined by the medical divisions of health departments."

Mr. Marx called upon the U.S. Public Health Service "to promote a balanced state and local health department organization," and charged that "too frequently sanitary engineering programs are so under-financed in relation to other public health activities that only skeleton crews are employed which are in a position barely to take care of complaints."

G. E. Arnold, Assistant City Manager, San Diego, Calif., was author of a paper, "Colorado River Water for Domestic and Irrigation Purposes," which declared that taming of the lower Colorado River from "the flashiest, most turbulent and heaviest silt-laden stream ever to be treated for domestic and industrial use" is paying returns much greater than the cost.

"The picture of man struggling with this western demon and taming it surely will long remain an epic," the paper stated, and predicted that the returns from the taming of the Colorado will continue to be increasingly greater, in the form of productive land and the growing cities supported by it.

"The industrial and agricultural impetus which the Colorado River water has given the Southwest is beyond estimation," the paper declared in tracing the engineering accomplishments which saw the stream transformed from one once described as "too thick to pour and too thin to plow," into one now supplying clear water to over a half million acres of irrigated land in the lower basin, to nearly 60,000 persons in the basin who use it for domestic purposes, and to 2½ million others in the coastal plain, some of them 300 miles from the river.

The third paper was by A. M. Rawn, chief engineer and general manager, Los Angeles County Sanitation District. Its title was "Some Effects of Anerobic Digestion Upon Sewage Sludge." This paper related the results of an investigation aimed at discovering the numerical value of some of the changes occurring in digesting sewage sludge. The work was inspired by Mr. Rawn's experience in the disposal of digested sewage sludge from temporary military establishments during World War II, and by public health regulations in some states to the effect that digested sewage sludge may not be discharged into state waters, fresh or salt.

Results of the investigation indicate that where sludge banks will not be formed there is little, if any, reason why well-digested sewage sludge may not be disposed of by dilution along with primary clarifier effluent where conditions will permit of the disposal of the latter with safety.

Evolution of Aerial Photography as Valuable Aid to Engineering Work Is Traced

EVOLUTION OF AERIAL PHOTOGRAPHY, from race-track photo-finish work to inventorying troop movements and beaches before landings in the war, to economic utilization in dam design, reservoir studies, highway location, city planning and a host of other civil engineering uses, was traced in a paper presented before the Surveying and Mapping Division.

Leon T. Eliel, vice-president, Fairchild Aerial Surveys, Inc., Los Angeles, was the author of the paper, "Postwar Photogrammetry," which opened the meeting, over which Prof. G. Brooks Earnest, Cleveland, chairman of the Division's executive committee, presided.

"The war gave such a spectacular demonstration of the many applications of aerial photography and

photogrammetry that today engineers everywhere recognize these new tools a something very practical and ready for immediate use in their problems," Mr. Eliel said. He emphasized, however, that "by 1941 the aerial cameras which were used during the war were to a large extent already developed, and the only thing the war did was to take some of these cameras and apply them in a new way."

Notable among these new applications was "the grouping of three cameras together for photographing from horizon to horizon," Mr. Eliel said. "This method was largely developed by the Army for purposes of making aeronautical charts, and at one time it was the purpose of the Army to map the entire world to which it had access."

Much of the postwar engineering aerial photography is achieved by a method which grew out of race-track photo-finish work, which also was used extensively in the war, Mr. Eliel said. He stressed the economies offered by aerial photography in engineering work, particularly where accessibility was an important factor to be considered.

As far back as 1930, he said, photogrammetry mapped the workings around the Boulder Dam site, and again when the gates of the dam were closed and the reservoir started filling with water, a contour map of the entire area of the reservoir was made.

"This map made of the empty reservoir was designed as a base from which studies could be made to determine the rate at which the reservoir was being filled with silt," he said.

Mr. Eliel stressed, also, the uses being made of the art in settling litigation and disputes arising over conditions in an area at any specific time, and for studying the gigantic task of taming the unruly Colorado River.

"Areas subject to flood were studied from photography made early in the project history," he said. "The delta of the Colorado has been photographed to study the vagaries of this menacing river, which in flood thrashes itself from old channels to new channels, and back again. The aerial photographic maps showed this delta in minutest detail, so that every channel, both new and old, is apparent, and the work of planning the control of the river was thus greatly expedited."

Other papers were: "Cadastral Engineering Surveys and Resurveys, History, Scope and Future," by A. C. Horton, Jr., Acting Chief Cadastral Engineer, Bureau of Land Management, Dept. of the Interior, Denver, Colo.; "System of Plane Coordinates for Arizona," by Comdr. Roland D. Horne, Supervisor of Southwestern District, Coast and Geodetic Survey, Los Angeles; and "Property Surveys Must Fit the Title," by William C. Wattles, Chief Engineer, Title Insurance and Trust Co., Los Angeles.

Division Discusses Engineer's Role in Development of Aviation Industry

CLOSER COOPERATION between airport managers, aircraft manufacturers, and the engineers who design the ports was emphasized as a means of avoiding "the pitfalls of speedy obsolescence and inordinate maintenance encountered by the country's early highway system," at the Air Transport Division session. Current conflict of viewpoints was brought out following the reading of a paper by R. W. F. Schmidt, Superintendent of Airports, Civil Aeronautics Administration, Santa Monica, Calif., when a paper prepared by Alfred J. Ryan, Denver, chairman of the Air Transport Division's executive committee, discussed Mr. Schmidt's paper. Mr. Ryan's discussion was read by Russell W. James, Highway Bridge Engineer, U.S. Public Roads Administration, Denver. John McGowan, Denver, secretary of the Division's executive committee, presided at the session.

Mr. Schmidt decried engineering practices "which insist upon costly importations and procedures to gain a few percent on some theoretical figure," and charged this may cause the airport programs to "break down in their inception," thus retarding the "Air Age."

The engineer's viewpoint, Mr. Ryan emphasized in citing the need for adequate rather than "cheap runways which aren't necessarily economical," is one that seeks to avoid the experience in construction of the early-day highways. Mr. Ryan's full discussion appears in this issue of CIVIL ENGINEERING, page 24.

In another paper, "Factors in Airport Drainage," Edward Koehm, U.S. Engineer Office, Los Angeles, stated that even storms of such ferocity that they occur but once in 100 years should be anticipated in planning the drainage facilities of airports and it is mandatory that ports with a high intensity of traffic have at least one runway designed to be free of flooding from such a storm. In his paper, prepared in collaboration with R. J. Schultz, engineer head of the Los Angeles U.S. Engineer Landing Fields Section, Mr. Koehm said:

"Compared to other means of transportation, the airplane and attendant ground facilities and traffic techniques are now in the formative stage where much can be done to establish criteria for airfields that will insure the utmost safety to the traveling public, and at the same time will permit the maximum utilization of low-cost materials in the construction of the airport. The successful landing of an airplane weighing half a million pounds and moving at a speed of approximately 150 miles per hour on a runway surface severely taxes one's academic concept of force, acceleration and mass. Although airplanes of such weights are not now in existence, it is known that designs of such airplanes are being prepared. The immensity of the problem is brought home more forcefully when it is pointed out that the heavier-type railroad locomotives have weights of the order of half a million pounds. The heavier-type commercial transport airplanes in use at the present time impose wheel loads on the pavement that are in excess of the wheel loads nominally permitted the truck transports presently using the highways."

With the assistance of a series of charts, Mr. Koehm presented criteria and techniques "that experience has shown to be of value in airport design work." He declared the major factors in airport drainage are quantity of runoff, design and layout of the drainage system and the grade layout of the entire runway and taxiway system.

"The importance of airport drainage and the inherent difficulties of its solution are readily apparent if one realizes that the major airports are usually located in flat, low-lying areas which do not permit adequate transverse or longitudinal slopes to facilitate runoff," Mr. Koehm said.

A third paper, "Airport Weather Determinations and Equipment Used," was presented by E. L. Felton, Meteorologist, U.S. Weather Bureau, Phoenix, Ariz.

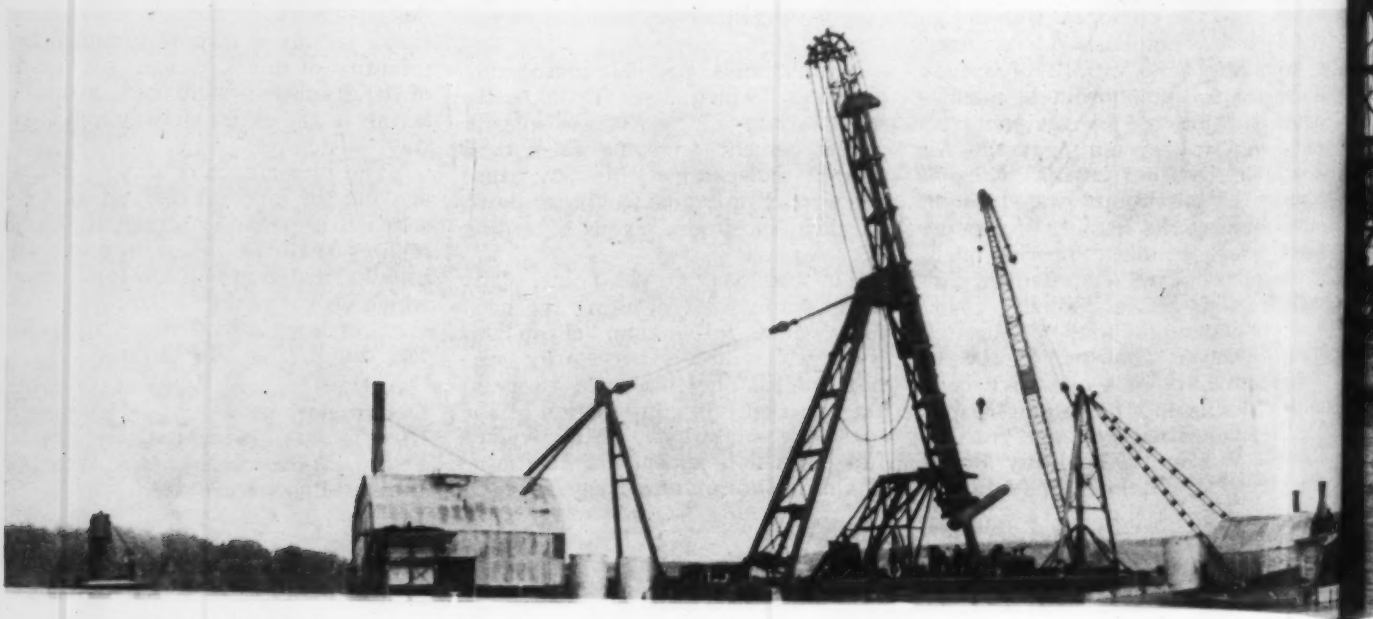
Garrison Preconstruction Contracts Inaugurate 75,000,000-Cu Yd Embankment Project

PRELIMINARY STEPS in harnessing the Missouri River are being taken by U.S. Army Engineers at Garrison, N.Dak. Four contracts—for access railroad, access highway, construction bridge and construction town—have been let for preconstruction work on the $158,000,000 dam and reservoir project from funds appropriated to date amounting to approximately $6,000,000. Garrison Dam, when completed, will be the world's largest rolled-earth-fill structure. The reservoir—extending a distance of 200 miles upstream from the dam—will have a storage capacity of 23,000,000 acre-ft as compared with 19,500,000 acre-ft capacity at Fort Peck.

GARRISON DAMSITE is approximately 75 miles north of Bismarck and 10 miles south of Garrison in McLean County, N.Dak. The site is in an area not readily accessible by improved roads and railroad facilities and is remote from any large cities. It was therefore necessary to initiate and complete a substantial pre-main-dam construction program before beginning actual construction on the main project. This program is well under way with the funds already appropriated. The preconstruction program will provide access facilities in the form of a paved highway connecting U.S. Highway 83 with the construction town, and an access railroad from the Soo Line Railroad (Minneapolis, St. Paul & Sault Ste. Marie) to the construction town, a construction bridge across the Missouri River at the downstream toe of the dam, and housing facilities for the initial construction forces.

In the fall of 1945, when it was apparent that Congress would appropriate funds in the Deficiency Bill to initiate construction of the Garrison Dam, it was deemed advisable to establish an area office in the vicinity of the dam to coordinate all field surveys and subsurface explorations in connection with the project and make preparations for field supervision of contract work. Accordingly, the Bismarck Area office was opened in Bismarck, N.Dak., on September 1, 1945, under the direction of Lt. Col. John W. Sibert, Jr., Corps of Engineers.

FLOATING PILE DRIVER, owned by Missouri Valley Constructors, Inc., drives 24-in. pipe piles for river piers of combination highway and railroad construction bridge across Missouri at Garrison, N.Dak. Piles are handled in 50-ft sections and field-welded at joints. Leads—with Model S-10 McKiernan-Terry pile hammer capable of delivering 32,500 ft-lb of energy per blow—are readily moved to drive batter piles in any direction. Piles are driven to minimum penetration of 100 ft. Maximum load of 190 tons is applied in load-bearing test on vertical 24-in. pipe pile at left of picture.



H-SHAPED 150-MAN WORKMEN'S DORMITORY appears in foreground of aerial view showing construction town of Riverdale. Combination central heating plant and fire station appears next to right. Long building in background is warehouse. Temporary Okes Construction Co. camp is in general area indicated by curved-roof huts in background.

The first contract on this huge project, in the amount of $398,315.45, was awarded on April 8, 1946, to the William A. Smith Construction Co., Inc., of Houston, Tex., for the construction of approximately 11.8 miles of access railroad. This contract is divided into two stages. Stage 1 provided for all grading, drainage structures, and a timber-pile-supported deck-steel-girder highway overpass. Stage 2 provides the ballast, ties, and rails for a main-line track complete in every respect and a 4-track classification yard. All rails, tie plates, joint bars, and track bolts were furnished by the government from surplus military stocks.

The initial contract was followed by three other principal contracts, as described below:

A contract was awarded on April 15, 1946, to the S. J. Groves & Sons Co., Minneapolis, Minn., for construction of approximately $13^1/_2$ miles of east access road to the construction town and to the downstream toe of the dam at the left bank. The original contract amount is $1,163,030.45. This contract is also divided into two stages. Stage 1 provides essentially for all grading, drainage structures, and a temporary gravel surface. Stage 2 provides a 24-ft paved slab from U.S. Highway 83 to the construction town.

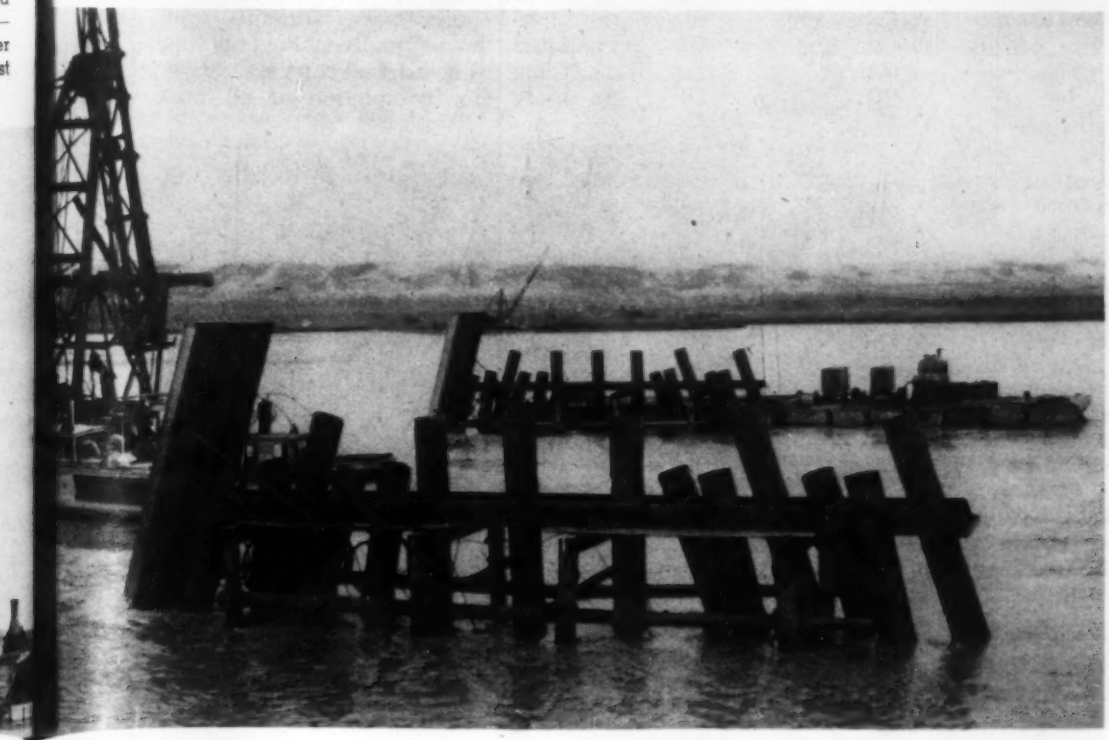
The contract for the construction bridge was awarded April 26, 1946, to the Missouri Valley Constructors, Inc., of Leavenworth, Kans., and Winston Brothers Co. of Minneapolis Minn., in a joint venture. The original contract amount is $1,303,168. This contract provides a deck-steel-girder combination railway and highway bridge across the Missouri River at the downstream toe of the dam. The bridge is 1,450 ft long with a 26-ft clear roadway and 4-ft sidewalk. Nine spans, approximately 150 ft in length, supported on concrete-capped pile piers, make up the bridge. Each of the eight river piers is composed of fifteen 24-in.-dia pipe piles with $^3/_4$-in. wall thickness, driven to a minimum penetration of 100 ft. Reinforced concrete abutments on the east and west bank of the river are supported by 14-in. steel H-columns.

Contract for Construction of Town

The fourth principal preconstruction contract was awarded on June 3, 1946, to the Okes Construction Co. of St. Paul, Minn., for construction of Stage 1 of the construction town known as "Riverdale." The original contract amount is $2,312,263.60. This contract provides for the construction of 80 temporary buildings with necessary grading, roads, and utilities to serve the needs of an estimated 450 employees of the contractors and the government during the initial stages of construction.

Two 150-man workmen's dormitories, workmen's mess hall, temporary administration building, soils laboratory, dormitory hotel, trailer-court utility building, warehouse, central heating plant, public garage, and individual housing for 52 families are included under Stage 1 of the townsite. Ultimately, under future contracts for Stages 2 and 3 of the townsite, facilities will be provided to serve the needs of an estimated 2,400 employees of the contractors and the government. It is estimated that this will result in a total population of about 5,400 people in the town of Riverdale, including families.

The initiation of the above-described preconstruction projects was under the supervision of the Corps of Engineers, War Department, Omaha, Nebr. The magnitude of the project and the many problems in connection with the design and construction of the dam and appurtenant works required a closer supervision than could



PIPE-PILE FOUNDATIONS, for first two westerly piers of construction bridge, of 24-in.-dia pipe are shown prior to capping with reinforced concrete. Derrick boat in far background is placing riprap protection stone on approach fill for east bridge abutment. View is looking across Missouri River along downstream toe of Garrison Dam.

CONSTRUCTION OF EAST ACCESS ROAD requires 77 drainage-structure installations of concrete and corrugated metal pipe varying in diameter from 18 to 72 in. Double-line, 72-in. multiplate pipe installation shown here is fitted with vertical struts and top and bottom sills and backfilled 37 ft to required density by use of air tampers.

be efficiently supplied from the remote Omaha District office. Accordingly, the Chief of Engineers activated the new Garrison District on July 1, 1946, and named Col. W. W. Wanamaker, M. ASCE, Corps of Engineers, as the District Engineer to supervise the design and construction of the Garrison Dam and Reservoir Project. Lt. Col. Noel H. Ellis, Corps of Engineers, was appointed executive officer to the District Engineer. The district established temporary headquarters at Fort Lincoln near Bismarck, N.Dak., and organized in five main divisions. These divisions, with their respective chiefs, are as follows: Administration Division, L. T. Webb; Engineering Division, Robert H. Hayes; Construction Division, John W. Sibert, Jr.; Real Estate Division, Roy Dory; and Town Management Division, James E. Stogsdill. The Garrison District will establish permanent headquarters at Riverdale upon completion of Stage 2 of the construction town, scheduled for July 1, 1948.

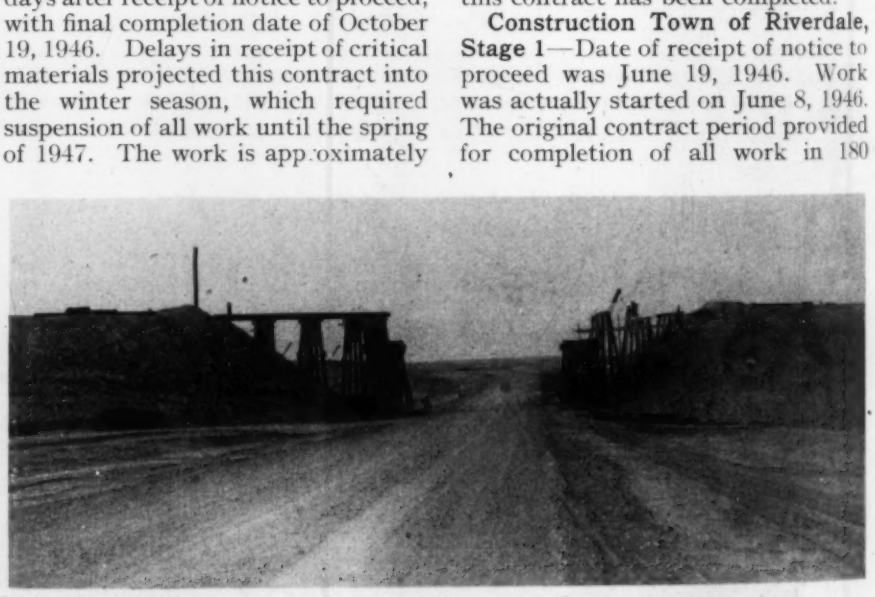
Progress to date on the four principal preconstruction contracts is briefly described as follows:

Access Railroad—Notice to proceed on Stage 1 of this contract was received by the contractor April 19, 1946. Actual work started April 30, 1946. The original contfact period for Stage 1 was 150 calendar days after date of receipt of notice to proceed, or final completion date of December 16, 1946. Delays due to critical shortages of materials required an extension of the contract period for this phase of the work until the spring of 1947. Stage 1 is approximately 90 percent complete. Notice to proceed on Stage 2 of the access railroad was received by the contractor on October 15, 1946. However, work was actually started before that time, on August 26, 1946. The original contract period was 60 calender days after date of receipt of notice to proceed, with final completion date of December 14, 1946. The advent of cold weather required the suspension of this phase of the work until the spring of 1947. The estimated revised completion date is June 15, 1947. Stage 2 is 64 percent completed. All ties and rails and the first two lifts of ballast are in place, and the roadbed is usable for slow traffic from the Soo Line to the construction town of Riverdale.

East Access Road—Notice to proceed on Stage 1 of this contract was received by the contractor on April 22, 1946. Work actually started May 2, 1946. The original contract period for Stage 1 was 180 calendar days after receipt of notice to proceed, with final completion date of October 19, 1946. Delays in receipt of critical materials projected this contract into the winter season, which required suspension of all work until the spring of 1947. The work is approximately 92 percent completed, providing a usable gravel-surfaced road to Riverdale and to the left bank of the river. Notice to proceed on Stage 2 has not been issued. It is anticipated that this work will be accomplished during the construction season of this year. The contract period for Stage 2 is 120 calendar days after date of receipt of notice to proceed.

Construction Bridge—Notice to proceed was received by the contractor on May 10, 1946. Work actually started at the site on June 8, 1946. The original contract period was 300 calendar days after date of receipt of notice to proceed, with final completion date of March 6, 1947. Progress was delayed considerably by critical shortages of steel required for the foundation piles and superstructure. The steel H-piles for the right (west) abutment have been driven and capped. Pipe piles for the first two piers from the west have been driven and capped. Floating equipment is being used in the prosecution of the work on the construction bridge. It was therefore necessary to suspend river operations when the river froze over in November 1946. Work will be resumed in the early spring of 1947, and the estimated revised completion date is August 15, 1947. Approximately 25 percent of this contract has been completed.

Construction Town of Riverdale, Stage 1—Date of receipt of notice to proceed was June 19, 1946. Work was actually started on June 8, 1946. The original contract period provided for completion of all work in 180



ACCESS RAILROAD ties in with Soo Line at Riverdale Junction 11.8 miles from town site. Deck-steel-girder highway overpass, shown here, is included in first stage of contract Rails, tie plates, joint bars and track bolts are from surplus military stocks.

calendar days after date of receipt of notice to proceed, or by December 16, 1946. Progress was seriously handicapped by shortage of critical materials such as lumber, plumbing materials, sewer pipe, water supply pipe, wallboard, heating equipment, etc. All outside work has been substantially suspended during the winter season. Work is progressing on a limited scale inside of inclosed buildings. The estimated revised completion date is June 30, 1947. The contract is 40 percent completed.

Present Plans Outlined

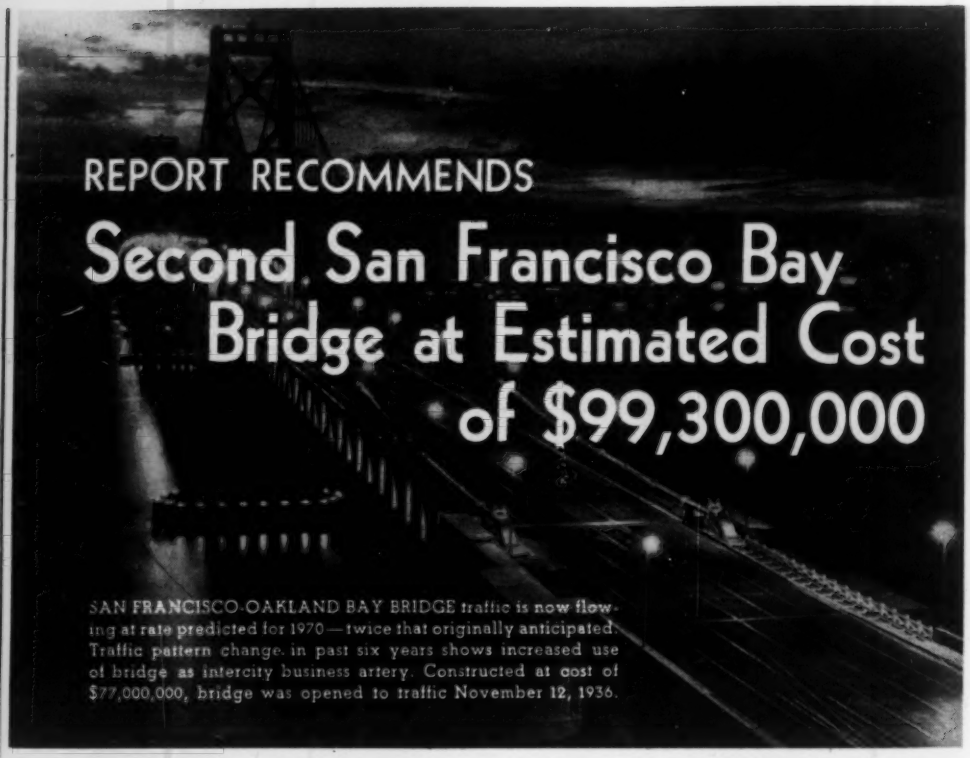
In addition to the 75,000,000-cu yd rolled-fill embankment, present plans for the Garrison Dam and its appurtenant works include the following major features: **Outlet works,** consisting of seven 30-ft-dia tunnels for diversion, flow regulation and power, located in the west abutment; **Powerhouse,** providing for the initial installation of about 128,000-kw capacity, in two units, and the ultimate installation of about 320,000, in five units, located near the west abutment at the downstream end of the outlet works; **Spillway,** consisting of a concrete ogee crest equipped with steel tainter-type gates, having a total discharge capacity of about 800,000 cfs, and a concrete paved discharge chute about 3,000 ft long, terminating in a stilling basin, located in the east abutment. The earth dam has a crest length slightly greater than two miles, a maximum height of about 210 ft, and a maximum base width, exclusive of an upstream impervious blanket, of about 2,500 ft. Present estimates indicate that total excavation will amount to approximately 90,000,000 cu yd, and total concrete will amount to about 1,500,000 cu yd—a greater volume than contained in any except a few of the largest existing *all-concrete* dams.

Project to Be Completed in 6 or 7 Years

Plans for future operations contemplate completion of the dam and appurtenant facilities in six or seven years of full-scale operations. In anticipation that 1948 will be the first year of full-scale operations, plans for 1947 construction contemplate completion of the four previously mentioned contracts, initiation of Stage 2 construction on the town of Riverdale, construction of a spur to the access railroad to extend down to and across the construction bridge, and initiation of a Stage 1 excavation and embankment contract on the dam proper. Included in the last-named item of work are site clearing and stripping and construction of foundation cutoff trenches and a steel sheet piling cutoff wall, which would permit large-scale embankment construction operations to proceed in 1948. Also included is construction of a length of full-size test tunnel on the location of one of the permanent outlet-works tunnels, which has been determined a necessary antecedent to the final design and construction of the battery of tunnels required.

It is anticipated that observations and measurements in the test tunnel will continue for a minimum period of six months, and some of them are expected to extend into the period of construction of adjacent permanent tunnels. It is expected that separate contracts will be awarded in 1948 and subsequent years for completion of excavation and embankment, the tunnels, the outlet-works headgate structure, stilling basin and tailrace, the spillway and the powerhouse, approximately in the order named. Construction seasons for embankment concrete, and other exposed work will be generally limited to seven months of the year, because of the severity of the winters in this region.

EMBANKMENT WITH ULTIMATE HEIGHT OF 110 FT is project of California Division of Highways on first 3.2-mile unit of projected 15-mile City Creek Road in San Bernardino Mountains. Erosion protection measures, as seen on face of slope, are taken as fill is constructed. Highway will be through artery for heavy summer and winter recreational traffic to playground areas at Big Bear Lake and Arrowhead Lake and will serve areas having estimated 20,000 permanent population.



REPORT RECOMMENDS

Second San Francisco Bay Bridge at Estimated Cost of $99,300,000

SAN FRANCISCO-OAKLAND BAY BRIDGE traffic is now flowing at rate predicted for 1970—twice that originally anticipated. Traffic pattern change in past six years shows increased use of bridge as intercity business artery. Constructed at cost of $77,000,000, bridge was opened to traffic November 12, 1936.

IN A REPORT to The California Toll Bridge Authority, C. H. Purcell, Hon. M. ASCE, California Director of Public Works, and F. W. Panhorst, Director ASCE, bridge engineer, recommend another transbay bridge from San Francisco to Oakland, Calif. The new bridge would be approximately parallel to and just north of the present San Francisco–Oakland Bay Bridge so as to make suitable connections with all important traffic centers.

Four terminal locations in San Francisco and four on the East Bay side were studied by the state engineers before recommending the parallel locations. In San Francisco they were: Telegraph Hill, Rincon Hill, Portero Point, and Hunter Point. On the East Bay side they were: Key Route Mole, Oakland Mole, the southerly line of Alameda, and Bay Farm Island. Studies indicate that the total cost of the project, including $20,000,000 for twin two-lane tubes under the Oakland Estuary with connections to the East Bayshore Freeway and to Alameda, would be $99,300,000 (see Table I). Not included in this estimate is a $5,700,000 item for interest during construction, which because of the fact that interest is paid from San Francisco–Oakland Bay Bridge revenues, is only a book charge.

Tolls to Pay for Structure

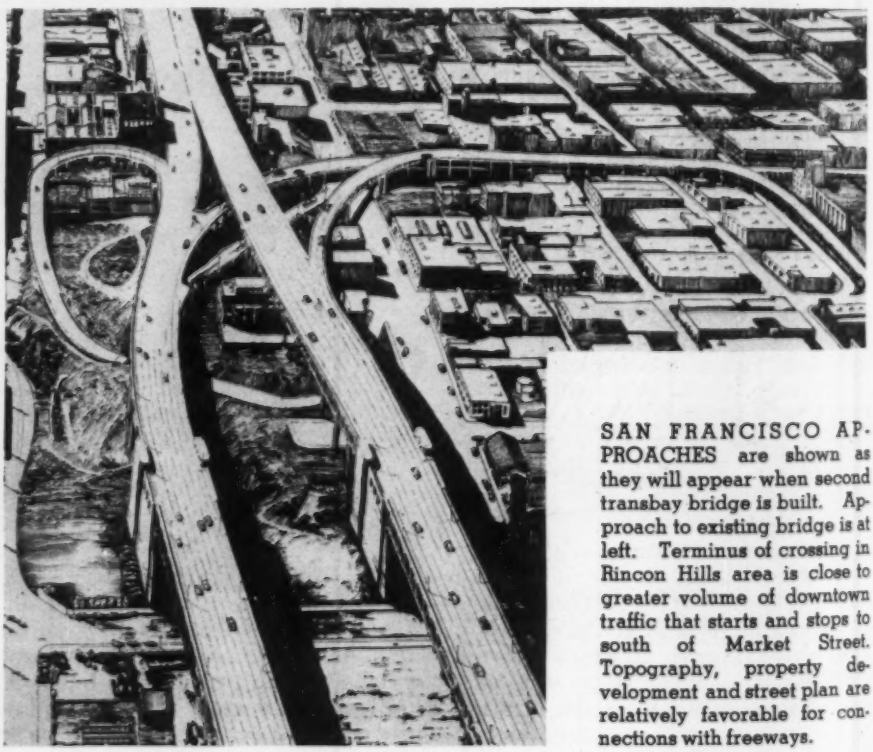
It is contemplated that tolls will be continued at the same rate on the San Francisco–Oakland Bay Bridge and the revenue combined with that collected from the second structure to amortize the cost. The report predicts that bonds to finance the new span will thus be entirely paid for by 1953.

Traffic studies on the present bridge, which was opened to traffic on November 12, 1936, indicate that the traffic pattern has undergone considerable change. In 1940 the greatest traffic always occurred on week-ends. At present, although week-end traffic has increased, the traffic during the five working days of the week is the greater. This change indicates the growing use of the bridge as an inter-city business artery. The year-day load factor (ratio of average daily load to maximum daily load in a year) has increased from 0.76 to 0.83.

Load factor increases as use of facilities approaches capacity. The daily load factor will increase, according to the report, by adjustment of business hours and shopping hab-

TABLE I. ESTIMATED COST OF SECOND TRANSBAY CROSSING

Bay and island crossings	$62,350,000	
Electrical, buildings and miscellaneous work	1,190,000	
San Francisco main approach	1,260,000	
Total main bridge construction		$64,800,000
San Francisco approach connections	$ 940,000	
Oakland approach connections	4,760,000	
Total approach construction		5,700,000
Property		4,300,000
Engineering, legal and insurance costs		4,500,000
Interest during construction		4,700,000
Total, bridge and immediate approaches		$ 84,000,000
Twin tubes under Oakland Estuary with connections to the East Bayshore Freeway and to Alameda:		
Construction costs	$18,000,000	
Engineering and general costs	2,000,000	
Interest during construction	1,000,000	
Total, Estuary crossing		21,000,000
Grand total		$105,000,000



SAN FRANCISCO APPROACHES are shown as they will appear when second transbay bridge is built. Approach to existing bridge is at left. Terminus of crossing in Rincon Hills area is close to greater volume of downtown traffic that starts and stops to south of Market Street. Topography, property development and street plan are relatively favorable for connections with freeways.

its. The limit for reasonable safety and tolerable delay has been estimated at 85,000 vehicles per day. The annual load factor may increase to 0.90, from which the annual capacity is estimated at 28,000,000 vehicles. In 1946, bridge traffic averaged 69,000 vehicles per day, of which 63,000 used the upper deck and 6,000 the lower deck. The peak day was April 21, 1946 (Easter) when 79,016 vehicles were counted, 76,609 of them on the upper deck. Almost as great a volume of traffic occurred on July 3 and November 29, 1946.

The number of vehicles using the lower deck in 1946 averaged 9 percent of the total vehicular traffic. A maximum daily traffic of 9,151 vehicles was counted on October 28, 1946; of these, 73 percent were trucks and 27 percent were buses. Peak rate was 900 vehicles per hour.

Congestion on the lower deck has been caused by slow progress of heavy trucks on the grade at the San Francisco end and west of Yerba Buena Island as well as by turbulence at the island turnouts. Heavy-truck accidents cause serious delay because of the narrower roadway and the use of heavy equipment. Although it cannot be said that with the present traffic pattern the economic capacity of the lower deck has been reached, it is close to the desirable limit.

Interurban Rail and Bus Traffic

Under the present conditions the interurban railway on the San Francisco–Oakland Bay Bridge is an essential form of transportation for handling peak-hour traffic. The capacity of the bridge roadway and terminal facilities would not permit the handling of present train passengers by buses and private vehicles.

The number of passengers carried by the Bridge Railway, including government employees going to and from Treasure Island, rose to 37 million for the year 1945, 11 million of which were government toll-free passengers. Because of the large decrease in war activities, indications are that train passengers will not exceed 22 million during 1947.

Bus passengers have shown a steady increase since 1943, the increase for 1946 over 1945 traffic amounting to 3 percent. Added convenience in the use of automobiles and buses which should result from the building of a second crossing is likely to cause a further decrease in interurban train traffic.

Since the Bridge Railway during wartime was capable of handling nearly twice as many passengers as now use it, and could be made to handle more if necessary, no provision for additional rail facilities seems justified.

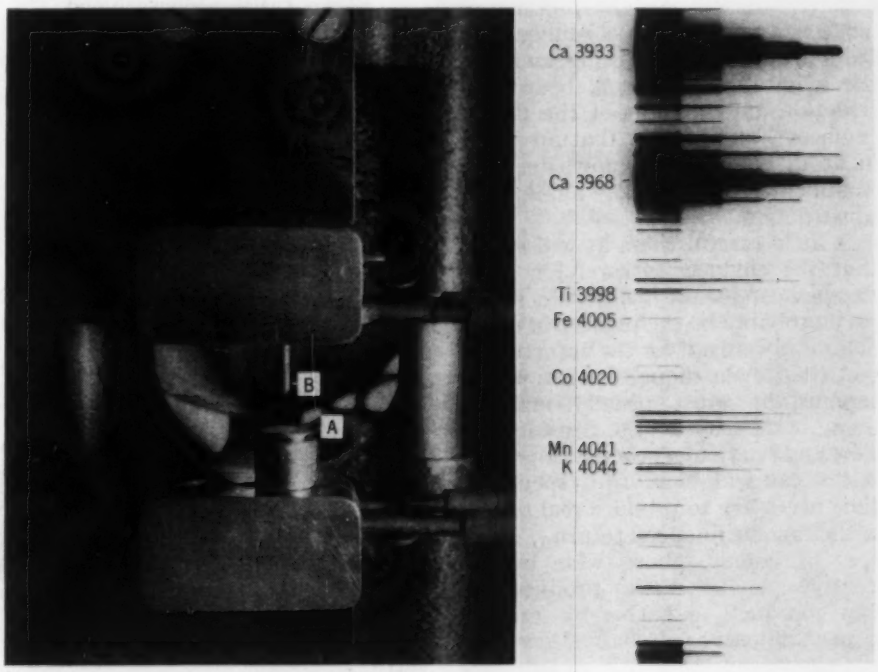
The report to the California Toll Bridge Authority, as prepared by Messrs. Purcell and Panhorst, includes detailed studies of traffic volumes and capacity of the existing bridge. A general study was made of alternate locations. Also included in the report are detailed origin and destination studies, available and potential terminal distributive highways and streets, foundation studies, and design and cost studies.

Spectrograph Analysis of Portland Cement

SPECTROGRAPHIC ANALYSIS of portland cement provides advantages of speed and freedom from human error. An operator can analyze eight cement samples in duplicate for seven elements, a total of 112 determinations, in 8 hours. The time required for the equivalent chemical analysis would be several days. Sufficiently accurate for control work, spectrographic analysis is believed advantageous for applications in which a considerable volume of testing is involved. Where standard samples are available, the method shows promise of ready extension to the analysis of cement raw materials and many ceramic materials.

An investigation by the research fellowship of the Portland Cement Association, cooperating with the Spectroscopy Laboratory of the National Bureau of Standards, led to the development of the spectrographic method for determination of the constituent elements of portland cement—particularly the minor elements that may contribute favorable or unfavorable properties to the finished concrete.

The method provides for the quantitative determination of the following constituents, which are reported as concentration of their oxides: aluminum, iron, magnesium, sodium, potassium, manganese, and titanium. In addition, suitable spectral lines are listed for the detection of lithium, chromium, strontium, and zirconium.



PRINCIPAL PROBLEM INVOLVED in spectrographic analysis of portland cement is to excite characteristic spectra of elements in sample so as to be reproduced. This is accomplished by new method of forming compressed pellet of cement mixed with binder of graphite powder, reference material of cobalt oxide and buffer of potassium nitrate (A in photograph at left). Pellet and graphite rod (B) serve as electrodes between which intermittent arc discharge is passed. Light from arc is observed with spectrograph, and photographed spectrum (right) is measured for characteristic lines of elements to be determined. Set of five exposures is made for each spectral line to permit accurate intensity measurement.

Modern Airports Depend on Technical Skill of Engineer for Safety, Adequacy and Economy

ALFRED J. RYAN, M. ASCE
Crocker & Ryan, Consulting Engineers, Denver, Colo.

THIS DISCUSSION was prepared for presentation at the ASCE Spring Meeting at Phoenix, Ariz., before the Air Transport Division by the chairman of its executive committee, Alfred J. Ryan. The discussion specifically answers the questions that are being asked—as evidenced at the Phoenix Meeting—by those in charge of constructing the many airports, large and small, that are needed in this country. The questions boil down to: "Should the engineer specialize exclusively in the airport construction field, or should he use the tools and 'know-how' that he has developed in other fields and apply them to scientifically designing what he knows will be safe, adequate and economical facilities?"

TO CLARIFY THE ENGINEER'S position in the matter of airport design, it is necessary to point out a few misconceptions—held by responsible persons in charge of our airport program—that are apparently based on a lack of understanding of engineering principles, background and activities.

Four basic misconceptions are obvious: First, that the engineer is, or ever has been a pioneer; second, that to be competent, an engineer must be an integral part of the industry that will use the product of his design; third, that cheapness and economy are the same thing, and that the inevitable results of cheap construction are the fault of the design engineer; and fourth, that advancement in engineering knowledge is a detriment rather than an aid to construction.

A little careful thought will reveal that the engineer is rarely, if ever, the pioneer in any field. He would very probably be the pioneer in many fields if it were not for the unfortunate fact that, even though he is a public servant, he must usually make a living. He may devote considerable time and study to a new development, but he can seldom afford to spend the time necessary to produce real results without some financial return. There are, of course, those who by inventive genius have produced a new product and thereby created a new industry. Usually, however, the early developments in any new field are carried on by those who use the facility, until the development reaches the point where those who are primarily interested in its advancement are willing to concede that their layman's knowledge of engineering is not enough—and then the engineer is called in.

For example, in the development of highways, the first facilities were trails following the paths of least resistance. Real highway engineering is relatively new when compared to the existence of trails and paths, for it did not come into being until the public realized that the cost of vehicle maintenance the loss of time, and the loss of life had reached such a point that it was necessary for highways to be designed rather than merely located by laymen.

Role of Engineer Misunderstood

The development of pure water supply has a similar history. The step from wells and streams to modern filter plants was a long and fateful one, and real progress was not made until the need for scientific help was realized.

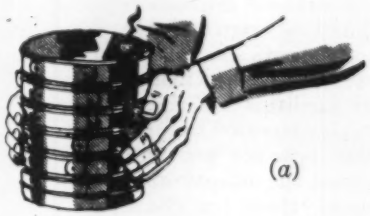
The mere realization of the need for engineering knowledge, however, by itself does not solve the problem. When first called in, the engineer is usually regarded as a necessary evil and is considered valuable only for his technical skill. The pioneers in the field are usually positive that their problems are unique, and that the engineer's knowledge of their economic and operational aspects which he may have gained in a similar field, can be of no value to them. They think the engineer should devote his technical skill to designing only what he is told to design, after which they will decide whether his is the right type of facility to meet their immediate requirements, and whether it is adaptable to their future requirements.

The engineer is expected to keep engineering costs to a minimum—no initiative, no experiments, no investigations beyond casual observation—just design from known technical procedures. It is just this attitude on the part of city councils and other governing bodies that is responsible for a large percentage of the too-narrow bridges, the inadequate water-distribution systems, the abandoned rights-of-way and, yes, even the poorly designed airports.

Even after he has succeeded in obtaining recognition of the importance of engineering considerations in the overall economic and operational

EXPERTS IN DESIGN AND CONSTRUCTION of airfields have developed necessary testing equipment and field and laboratory techniques for determining engineering properties of soils. It is only through intelligent application of this knowledge that safe and economical airports are built. Shown here is motor grader finishing sloping fill at edge of runway, at Seattle-Tacoma Airport in Washington.

GOOD DRAINAGE is basic requirement in economical design of modern airports. Inadequate systems for removal of surface and subsurface water at proposed sites such as saturated area shown here (left) can lead only to subgrade failures (right), unsafe runways and high maintenance costs.



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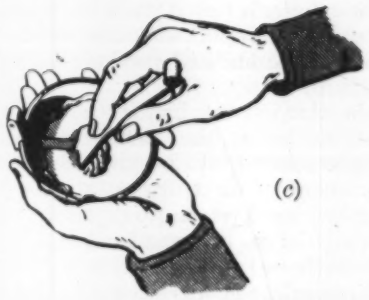

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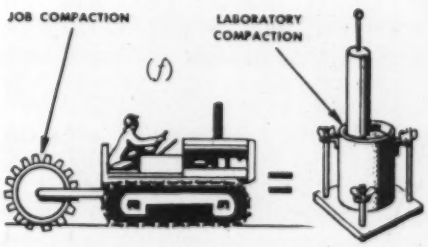

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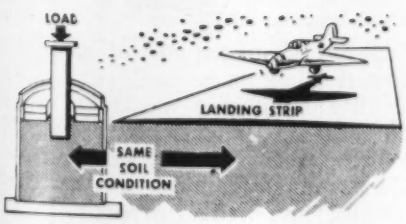

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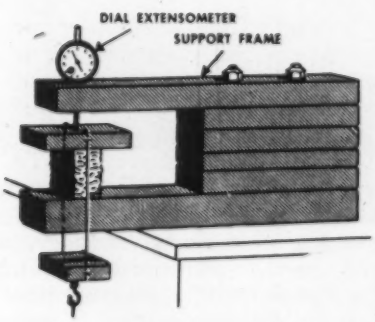


(h)

picture, the engineer cannot always obtain the results he would prefer. There are many times when the available capital is inadequate to provide the initial construction that will finally result in the most economical facility, and all that can be done is to provide the best construction, when considered from all angles, that can be built with the funds that are available.

Unfortunately inadequacy of funds is not the only reason for the construction of facilities that have a low initial cost but are not economical from the overall standpoint. Too often political considerations, selfish ideas, or stupidity on the part of governing bodies dictate how the facility shall be constructed.

New Engineering Techniques Resisted

Another major handicap encountered by engineers is the resistance to new ideas that comes from people who have some knowledge of an established procedure but lack the energy or the inclination to learn the advantages of a new development. Such people are usually too ready to criticize unfairly and belittle the new development. Invariably one criticisim is that it impedes progress by being too technical. Fortunately,

VARIOUS SOIL TEST procedures and nomenclature used by the U. S. Corps of Engineers are illustrated at left: (*a*) Mechanical analysis; (*b*) consistency range; (*c*) liquid limit test; (*d*) plastic limit test; (*e*) unit weight determination; (*f*) compaction for optimum moisture content; (*g*) California Bearing Ratio test; and (*h*) unconfined compression test. These illustrations appear in ARBA Technical Bulletin No. 107, 1946, "Soil Tests for Military Construction."

BEARING CAPACITY of existing structure is tested by plate method. Load is applied to plate by means of hydraulic jack against frame of loaded trailer. Amount of load applied, and pavement deflection recorded, give basis for computing safe wheel load for runway.

engineers and scientists have persisted in the face of such opposition and have continued to develop new ideas.

In his relations with the aviation industry, the engineer, in general, has now reached the stage where he is considered to be a necessary evil. The war was responsible for a tremendous acceleration in aviation development. As is usual under such circumstances, the industry has not been uniformly developed and a great many of the difficulties now being encountered, particularly by the airlines, are the result of lopsided planning.

Regardless of this, however, aviation will continue to go forward. It offers so many advantages to the world that its progress is inevitable. One thing that can and will materially assist in this advancement is cooperation between the engineers who are qualified to design airports and the people who are qualified to operate such airports.

Airport Engineer Must Be Recognized

One of the purposes for which the Air Transport Division of the American Society of Civil Engineers has been formed is advancement of the science of airport engineering. Its committees, which are made up of outstanding men in all fields of aviation, are working toward that end. There is little doubt that the engineers will keep the development of the applicable sciences at least abreast of the advancement of aviation. This having been accomplished, full realization of the services that engineers can offer to the industry awaits only full acceptance by the industry, and such acceptance is only possible if the industry understands and recognizes several basic facts.

Knowledge of Both Parties Needed

First among these is the fact that an engineer need not be a pilot or an airport operator to be qualified to design an airport. Linked with this is the realization that not every one who has been a pilot or an airport manager is qualified to pass judgment regarding decisions on some of the complex scientific problems involved in airport design. This does not imply that the knowledge of the pilot and airport manager is not a very necessary part of airport design. It does mean, however, that this knowledge by itself is no more sufficient than would be the technical knowledge of the engineer by itself. To produce the most satisfactory results the knowledge of both parties must be combined, and this can only be accomplished through whole-hearted cooperation.

Second is the fact than an airport, large or small, does not fall in the same category as a county road or a simple pipeline, which can be planned, designed, and supervised by the average county surveyor. To design any airport correctly requires a knowledge of the fields of soil mechanics, pavements, drainage, utilities, service transportation, and in most cases building construction. It is not a job for the type of one-man organization which will, single-handedly, conceive, promote, finance, design and supervise the construction of a project.

Same Basic Principles for Airport Design

Unfortunately, the volume of airport construction has not been sufficient to warrant the establishment of private engineering organizations large enough to have qualified men in all of the phases of airport design, with practices limited to that field of construction. There are many large organizations which have staffs qualified in various component fields and which provide engineering services for many types of construction. In fact, it is only by providing services in numerous fields that such organizations are economically justified in retaining such large staffs. Many of these organizations are well qualified to design airports. The basic principles of soil mechanics, pavements, drainage, utilities and the other facilities are the same for airport construction as for any other similar type of construction. It is true that the adaptation of such principles is varied, but the adaptation of basic principles to a specific problem is not a difficult task if the cooperation of persons familiar with the requirements of the finished product can be obtained.

The third fact which the industry must realize is the basic economic consideration that, because the advancement of air transportation will be rapid and is unpredictable, no airport, large or small, should be built without including in its planning a thorough consideration of future requirements. Any person—be he engineer or layman—who recommends the construction of an airport, even for the smallest community, that will be obsolete before its normal economic life can be realized is guilty of a disservice.

Cost of Airport Must Be Justified

The problem of financing the construction of an airport is a formidable one for most small communities. There are two solutions for this problem. One is to decrease the immediate cost of the construction of such airports by the intelligent application of sound engineering principles, and the other is to eliminate the construction of airport facilities where the cost of such construction cannot be justified. Many small communities would be better off with an undeveloped open field which could be used by small private aircraft under favorable weather conditions, than with an airport so developed that it not only will not accommodate aircraft of any material size,

but cannot be economically expanded to provide for such aircraft.

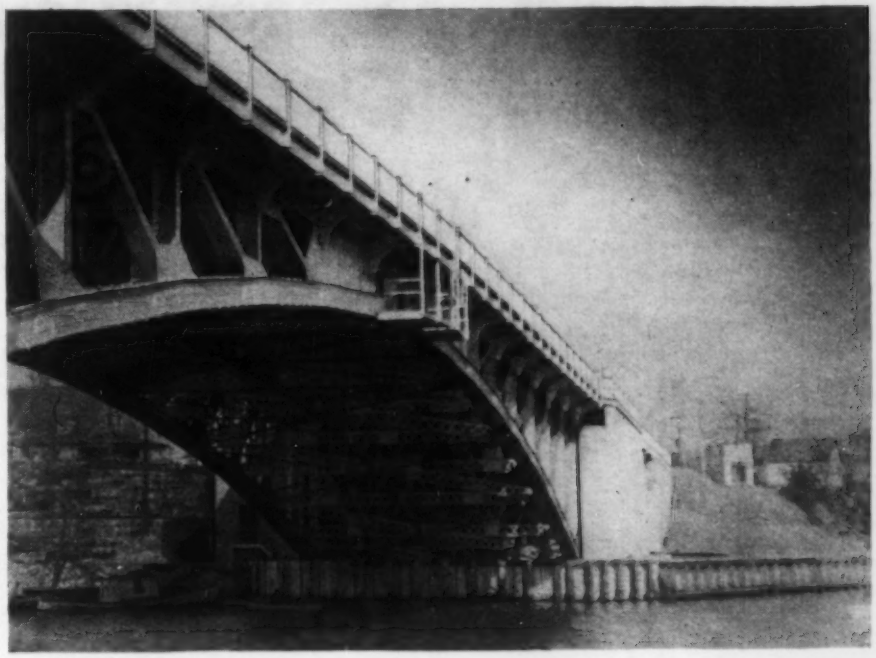
Fourth, the industry must realize that the application of present knowledge in the field of soil mechanics and pavement design is not a hindrance in the construction of airports of any size. It is only through intelligent application of this knowledge that safe airports can be built economically. The statement often made that there have been no serious runway failures is not true. A study of the records of the Army Air Forces will reveal several major failures of high-type runways, which were caused by loadings in excess of the maximum contemplated in their design. This does not mean, however, that every airport should be built to the rigid standards established for the design of military airports.

A complete and intelligent analysis of the soil conditions at any individual airport site will reveal the most economical method of stabilizing the runway foundations. Some of the unhappy conditions that have been mentioned are the result of half-hearted application of the principles of soil stabilization. It is impossible to establish a general soil stabilization procedure that can be applied indiscriminately to all airports and produce economical, or even uniform, results.

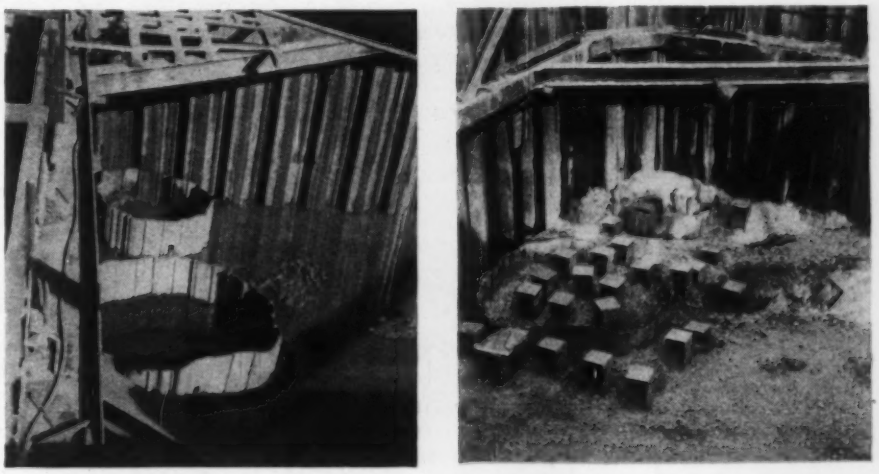
If real economy is to be obtained in the construction of runways, the established and proved principles of soil mechanics must be applied to the local conditions, and each airport must be considered as an individual problem. Only by such procedure, even though it results in engineering costs that may be somewhat higher than those for general construction, can true economy in airport construction be possible. There are numerous examples of the savings effected in this manner by various engineering organizations whose services are not limited to airport construction. It might be well if the results obtained by such organizations were investigated by those who are directing the progress of aviation.

There are many problems yet to be solved in the science of airport design, and the engineers are endeavoring to solve these problems. Full realization of their efforts cannot be obtained, however, until such time as the pilots, airport managers, and aircraft manufacturers who now control the destiny of aviation are willing to accept the fact that qualified engineers are partners in the solution of the problems of aviation, even though they have never flown a plane or managed an airport.

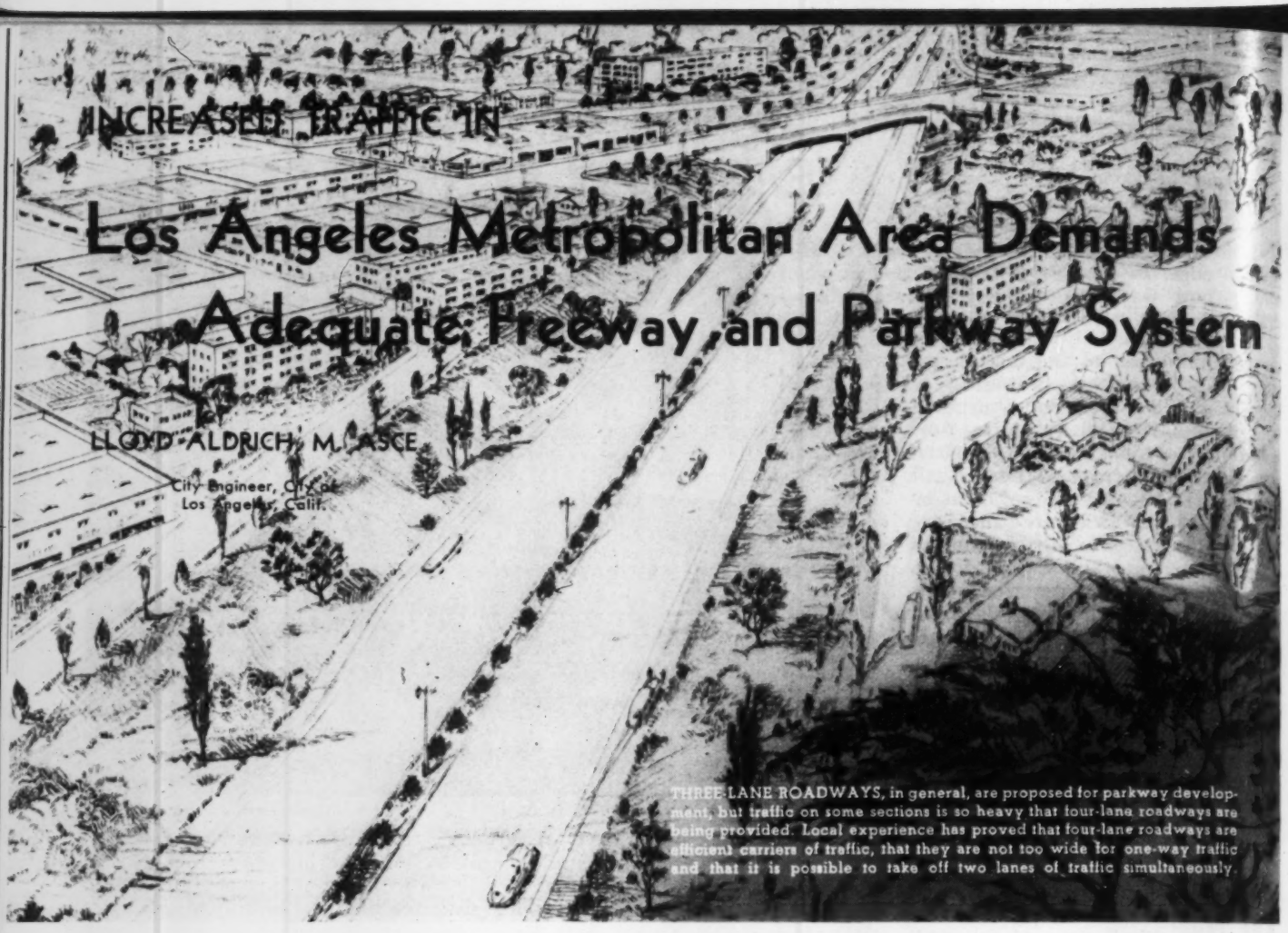
Record Double-Leaf Bascule



LONGEST DOUBLE-LEAF HIGHWAY BASCULE in existence—333-ft center-to-center trunnion distance—carries four-lane highway (U.S. No. 2) across Black River near Lorain, Ohio. Data withheld at time of construction because of war restrictions include: distance between abutments, 295 ft; clear channel, 180 ft wide, 24 ft deep; clearance above river, 33 ft; roadway lanes separated by 3-ft-wide center strip, 22-ft clear roadway each side flanked by 7-ft-wide cantilevered sidewalks; two 29-in.-dia trunnions, supporting trusses, carry about 800 tons each, 575 tons of which is counterweight. Problem of keeping dead weight and wind load, in open position, to minimum made light roadway construction imperative. Design is by Wilbur Watson Associates in Cleveland. T. E. Terry had charge of superstructure, and G. E. Schumann, foundations and piers. Mount Vernon Bridge Co., Ohio, fabricated and erected steel. Great Lakes Dredge & Dock Co. built substructure.



CONTRACTOR ABANDONED USE of circular sheet piling (left) to form outer shell of concrete for pier foundation because of difficulties encountered in driving piling to required depth. Cofferdam, kept water free, (right) permitted caissons to be cut off near floor level of piers. New design used 14-in., 102-lb piles with tips reinforced by two 11-in.-wide plates and 6 × 4-in. angles to reduce bearing pressure on shale. Concrete seal, 5 ft thick, was placed in dewatered hollow pier. Floating derricks handled most of pile driving and excavation. Ready-mix concrete was used except for counterweights, which required special mix that included iron ore for added weight.



THREE-LANE ROADWAYS, in general, are proposed for parkway development, but traffic on some sections is so heavy that four-lane roadways are being provided. Local experience has proved that four-lane roadways are efficient carriers of traffic, that they are not too wide for one-way traffic and that it is possible to take off two lanes of traffic simultaneously.

Los Angeles Metropolitan Area Demands Adequate Freeway and Parkway System

LLOYD ALDRICH, M. ASCE

City Engineer, City of Los Angeles, Calif.

CONSTRUCTION OF A PARKWAY SYSTEM in the Los Angeles area is essential if the anticipated continued growth of the city is to be attained. This system will provide facilities for a modern combined rapid-transit system for automobiles, buses and rail cars of a type suited to the widespread development of the area and will relieve a critical street traffic problem. Parkways—the basic framework about which the ultimate development of the area will be effected—will fix and stabilize property values and add attractive planted open areas to each district through which they pass. Every effort is being made to accomplish the construction of an adequate parkway system in the Los Angeles Metropolitan Area as rapidly as funds are provided, rights-of-way secured, and engineering plans developed for them. This paper was presented before the Highway Division at the Spring Meeting of the Society in Phoenix, Ariz.

PROBABLY THE BEST ARGUMENT for constructing grade-separated highways or parkways in the Los Angeles Metropolitan Area is the fact that there is concentrated in this area the greatest number of motor vehicles to be found in any like area in the United States. Records of the State Motor Vehicle Department indicate that there were 1,424,080 automobiles registered in Los Angeles County on December 31, 1946, of which over 99 percent are in the Los Angeles Metropolitan Area. Population estimates indicate that the present population of 3,703,903 will be increased to 6,000,000 before the year 1970. A conservative estimate would indicate an increase of 1,000,000 cars in this area at that time.

The Los Angeles Metropolitan Area has had a rapid continuing growth of population during the last half century. The early construction of a county-wide network of interurban electric lines encouraged a widespread distribution of population. Later, the rapid increase in the number and use of automobiles as a medium of transportation further encouraged the development of the area on a low-density basis. Climatic conditions are favorable to all-year use of motor vehicles so that it is not surprising that the private automobile has been shown to handle over 80 percent of the total passenger miles of travel in the area.

The problem of too many cars for the street space available is not a new one in Los Angeles. In 1924, when the county had only 1,650,000 population and 540,000 automobiles, traffic congestion along the major arteries was rapidly becoming intolerable. The City of Los Angeles prepared a "Major Traffic Street Plan" and set out to open and widen many new and existing streets. Later, with the advent of gas-tax allocations to cities, more street capacity was provided. Altogether, it is estimated that $600,000,000 has been spent in Los Angeles County on traffic streets and state highways since 1924. This expenditure has provided a fine network of surface streets but it has not solved the traffic problem, which has grown at a faster rate than that at which highways have been provided. Suspension of major street construction during the war has further increased the need for additional traffic facilities.

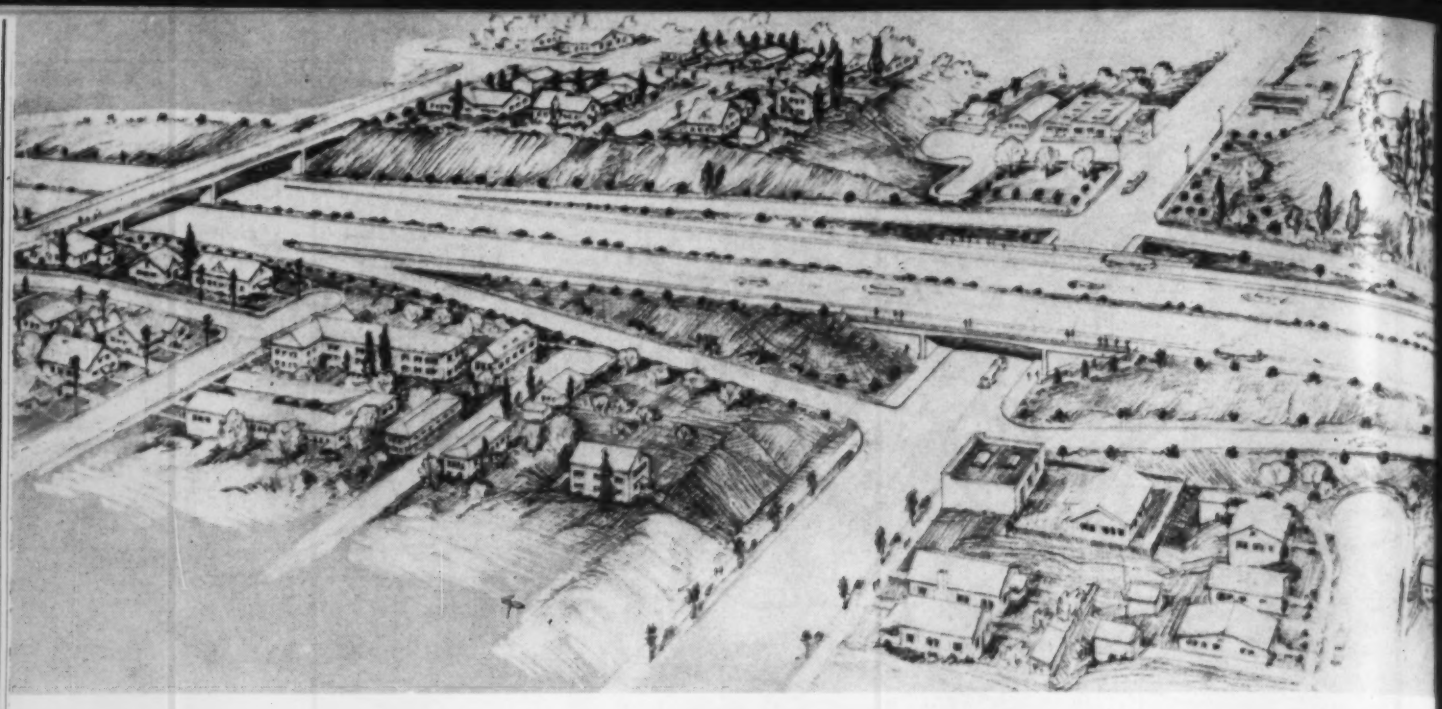
Traffic and Transit Survey

Back in 1937, city officials, and certain civic organizations, became greatly concerned about the traffic and transit problem. The answer was not known but it was obvious that something needed to be done. So

FIG. 1. MAP SHOWS PARKWAY and freeway plan as adopted by various agencies of Los Angeles Metropolitan Area. Predominant radial movement converges traffic on central business district. Inner loop distributes traffic to and from radial parkways.

with the city and private citizens cooperating, funds were raised for sponsoring a comprehensive traffic and transit survey. Technical consultants were retained to advise in the survey and to work with local governmental engineers in analyzing the needs of the community.

The problem was recognized as one of moving peoples as well as vehicles from place to place in the most effective and acceptable manner possible. Thus the facility provided would have to be of benefit to mass-transit patrons as well as to automobile riders. While a complete analysis was made of the possibilities of constructing a rail rapid-transit system, it was



BUS LOADING FACILITIES along Hollywood Parkway provide separate roadways at parkway level with passenger loading platforms and stairways leading to major cross streets. This view shows bus-loading facility where Hollywood Parkway passes over Alvarado Street.

recognized that conditions were not favorable to such construction here. The large area to be covered and the low population densities made it economically unfeasible to consider a complete system of rail rapid-transit. The riding habits of the people were an added argument against undertaking such construction at an early date.

The grade-separated parkway seemed to be the best facility for meeting all the transit needs of the area. First, the parkway would provide smooth non-stop flow of automobile traffic at relatively high overall speeds and with low accident frequency. Second, by the construction of special bus ramps and passenger-loading facilities at intervals along the parkways, they could be used for limited express bus routes. A 5 percent use by buses of the parkways would double their passenger-carrying capacity. Third, on certain selected routes, by widening the center dividing strip between opposing roadways, provision could be made at the time of construction for the addition of a rail rapid-transit line at such time as the required passenger movements along the parkway should justify such construction.

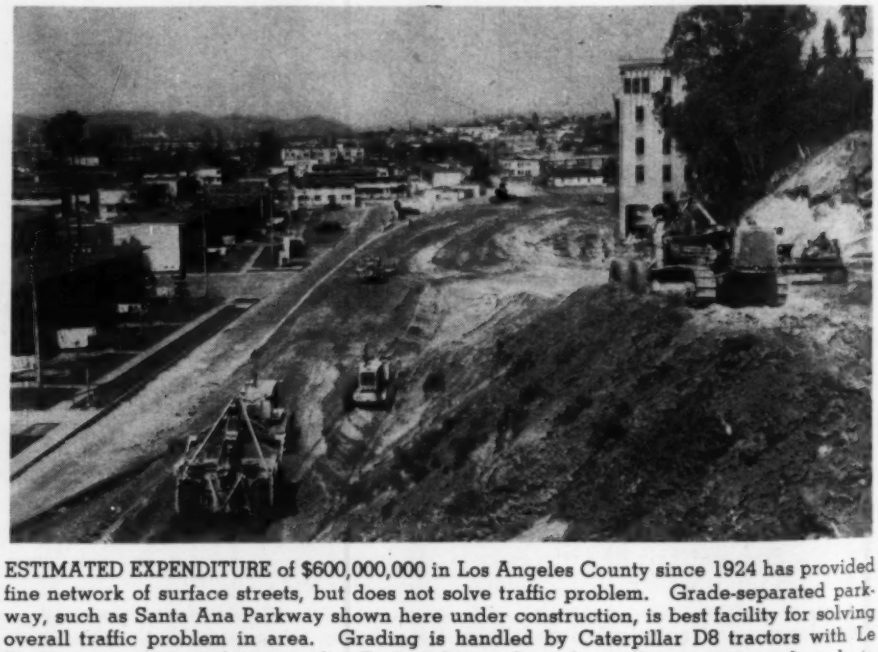
These principles were used by the Transportation Engineering Board in developing its report of 1939, entitled "A Transit Program for the Los Angeles Metropolitan Area." The major recommendation of this report was that an immediate start be made on the progressive construction of a system of grade-separated express highways or parkways in the area. Initial announcement of this plan caused much comment, as many believed such a system was beyond the means of the area to finance. At that time, however, sections of the Arroyo Seco Parkway, the Hollywood Parkway and Ramona Parkway were already being planned for construction.

Successive review by planning boards, the State Highway Division, the county, and the city engineers of the communities within the area, as well as by the Automobile Club of Southern California and other civic organizations, has caused this plan, with some modifications and normal additions, to be generally accepted and adopted as the physical plan of parkways to be eventually constructed in the area. It is interesting to note that there is also substantial agreement as to the priority of construction for the first 10 years.

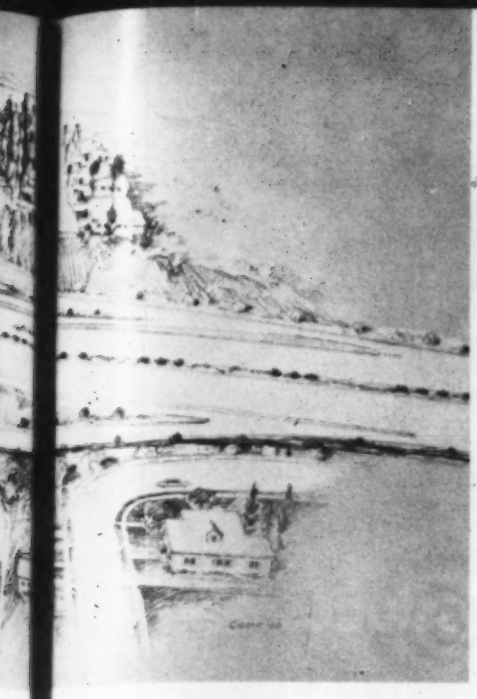
General Features of Parkway Plan

The parkway plan as it has been generally adopted by the various agencies of the metropolitan area is shown in Fig. 1. This plan is a development of that presented by the Transportation Engineering Board in 1939 with only such normal additions and modifications as would be made in any plan over a period of years.

One of the predominant traffic movements is a radial one converging



ESTIMATED EXPENDITURE of $600,000,000 in Los Angeles County since 1924 has provided fine network of surface streets, but does not solve traffic problem. Grade-separated parkway, such as Santa Ana Parkway shown here under construction, is best facility for solving overall traffic problem in area. Grading is handled by Caterpillar D8 tractors with Le Tourneau scrapers in foreground. Tractor-drawn sheepsfoot roller compacts subgrade in background.



on the central business district of Los Angeles. At the present time, about 500,000 cars enter this district daily. To handle this large movement, it is obvious that a number of radial parkways leading into the central district will be required, and these have been included in the plan.

An inner loop of parkways immediately adjoins the central district. This loop has the purpose of distributing traffic to and from the radial parkways. On and off ramps will connect with a series of one-way east-and-west streets to simplify movement of traffic between the parkways and the surface street system.

In addition to the heavy radial movement of traffic, there is heavy crosstown traffic. This cross movement of traffic on the present street system, with its intersections at grade, is responsible for the main traffic delays now experienced. It has been necessary therefore to provide parkway routes roughly circling the downtown area. Such routes are provided by the Normandie-Slauson parkways on the west and south, and by the Allesandro-Colorado-Concord parkway on the west, north and east.

The heavier traffic districts of the metropolitan area are completely bypassed by the Sepulveda Parkway, which enters the area from the northwest and then circles southerly and easterly around the outskirts of the City of Los Angeles. The Foothill, Arroyo, Concord and Los Angeles River parkways form another bypass to the north and east of the central part of the area.

Many of the parkway routes, such as the Long Beach, River and Colorado parkways, provide direct interconnections between various cities and centers of population in the area. Others provide special service to important facilities, such as the Inglewood and Crenshaw parkways leading to the Los Angeles Airport, and the Santa Monica and Venice parkways leading to the beach playground areas along the shoreline. Because of favorable climate, these beaches are used for a much longer season than in most localities. The parkway routes included in the overall plan will effectively serve all long-distance travel needs of the people of the area. The entire system as shown in Fig. 1 includes 613 miles of parkways.

It is estimated that with the construction of the complete system of parkways, the surface street system will be directly relieved of 50 percent of its motor-vehicle traffic. An effective rapid-transit bus and rail system coordinated with these parkways will tend further to reduce the street traffic. It is therefore believed that except for filling out the grid of surface streets in undeveloped areas, it will not be necessary to continue the expensive program of opening and widening surface streets. The parkways, although more expensive to construct per mile, are capable of carrying tremendous traffic loads with safety and with average overall speeds at least twice those attained on surface streets.

The war has delayed the construction of some of the parkway routes which had been previously approved for acquisition and construction. Portions of the parkways completed before or during the war period have proved their worth in carrying wartime and postwar traffic.

Parkways Now Completed

Sections of two parkway routes, the Hollywood Parkway, from Barham Boulevard to Highland Avenue, and the Arroyo Seco Parkway from Glen Arm Street, Pasadena, to Avenue 22, Los Angeles, have been in operation since January 1, 1941. The Arroyo Seco was extended to Adobe Street, and was completed on December 31, 1943. The Ramona Parkway from Los Angeles River to the east city boundary, which was started before war restrictions were placed on heavy construction, was delayed by these restrictions but completed on August 14, 1944.

Twenty-four-hour counts of traffic taken on ordinary week days in February 1947, recorded a daily traffic flow of 87,285 cars on the Hollywood Parkway through Cahuenga Pass and 86,127 on the inner section of the Arroyo Seco Parkway. Both these parkways have separate roadways 4 lanes wide for travel in each direction. Traffic on the Arroyo Seco Parkway during the afternoon peak hour was recorded as 9,550, of which 6,850 cars were traveling northward away from the business area.

These figures show the tremendous capacity of the parkways and their great worth to the community in the handling of traffic. A recent test made by engineers of the Automobile Club of Southern California recorded a gas consumption of only 0.8 gal for a 16.59-mile round trip on the Arroyo Seco Parkway as compared to 1.3 gal for a 17.9-mile trip on regular surface thoroughfares. This would indicate a saving of about 5 cents per trip along the 8.3 miles of the present Arroyo Seco Parkway, or a tremendous aggregate saving to the many thousands of motorists using the parkway daily.

The safety record of the parkways is also impressive. Analysis of the accident record of the Arroyo Seco Parkway and Wilshire Boulevard and Figueroa Street, two major surface arteries, indicates 5 times and 9 times, respectively, as many accidents per vehicle mile of travel on these streets as on the Arroyo Seco. The favorable effect of the construction of a number of parkways on the accident record of this area can readily be seen.

Present Parkway Construction Program

Parkways authorized for construction at the present time include the Hollywood-Santa Ana Parkway from Vineland Avenue to a point east of the city limits of Los Angeles. This is one of the primary state highway routes through the area and is also on the federal interregional highway system. Acquisition of rights-of-way is practically completed, and construction of 12 grade-separation structures and 2 miles of these parkways is now under way.

As a north-south unit, construction has been authorized for extending the Arroyo Seco Parkway to a connection with the Hollywood Parkway, then continuing it as the Harbor Parkway southward to Olympic Boulevard. Plans are being prepared for its further southward extension. A 3.7 mile section of the Terminal Island Freeway, a naval access-road project commenced during the war, is under construction to provide better access to large permanent Navy facilities on Terminal Island.

With the exception of the Terminal Island Freeway, which is being constructed entirely with federal funds, each of the parkways constructed or authorized for construction has been financed principally from state highway gas-tax funds. These are insufficient for the provision of parkways

(*Continued on page 74*)

New Construction Technique Reduces Cost of Large-Scale Housing in New York

JOHN P. RILEY
Director of Development
New York City Housing Authority

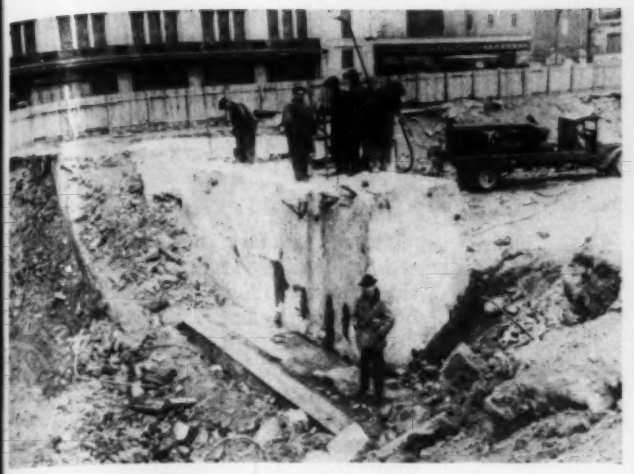
CONCRETE FLOOR SLAB is poured for unit of Brownsville Houses in Brooklyn, N.Y. Project, when completed, will have 27 six-story buildings and will house 1,338 families. Dowels for column-reinforcing-steel connections can be seen projecting from floor slab.

LARGE-SCALE HOUSING—as we know it today—is a development of the past decade. Whether publicly or privately financed, it is here to stay. New design features, better construction techniques, economical use of materials and labor—as developed by the New York Housing Authority in constructing 14 large-scale housing projects to house 57,000 persons at a cost of $90,000,000 for land and buildings—are applicable to all large-scale housing projects regardless of who does the financing. The Authority's post-war program—already under way—will add 16 more projects to house 80,000 persons at a cost of $225,000,000 for land and buildings.

That large-scale housing is no longer an experiment can be seen without going outside New York City. In addition to the New York Housing Authority's program, the Metropolitan Life Insurance Co. has a project already under way. Housing developments are contemplated by other insurance companies, and by the various savings banks under legislation recently enacted by the State of New York.

The first three public housing projects in New York City were: First Houses, Williamsburg, and Harlem River Houses. They were built, and are still owned, by the federal government. The New York Housing

BEFORE AND AFTER views show transformation of commercial area along East River Drive between 102nd and 105th Streets in Manhattan, N.Y., into modern 1,170-family housing development. East River Houses have distinction of being first New York City Housing Authority project to use construction higher than six stories, thus marking turning point in design and construction.



HEAVY MASS CONCRETE foundation is cleared from site of Elliott Houses—between 25th and 26th Streets, Manhattan, N.Y.—by drilling and blasting. Drills are operated by 205-cfm capacity Ingersoll-Rand compressor, in background.

MATERIAL LOADED DIRECTLY into trucks by $1\frac{1}{2}$-yd shovel is hauled from excavation by means of dirt or wooden ramps, depending on condition of job. Skull-cracker weighing 3,000 lb, left foreground, is used for breaking up masonry structures or footings.

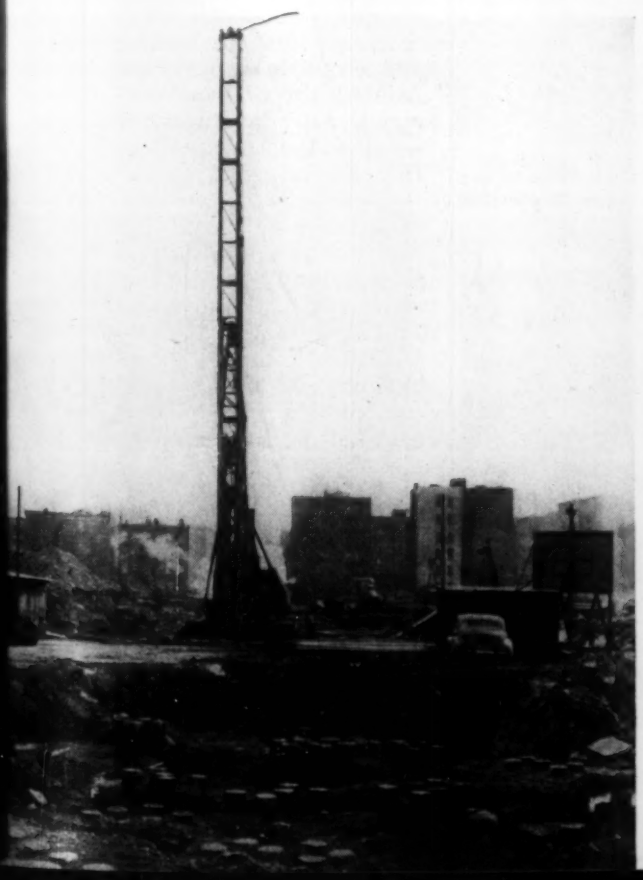
Authority operates them on a lease basis. Their total population is 2,300 families and the cost of construction alone was $5,400 per apartment.

Construction Costs Cut

In 1938, the New York City Housing Authority started its own building program. Since then, and until the war halted building operations, eleven projects, housing almost 15,000 families, were completed. The average cost for construction alone was $3,300 per apartment and some have been built for under $3,000. These projects are just as well built as New York City's first three public housing projects. In the writer's opinion they are better built.

What made it possible to cut construction costs 60 percent almost overnight? The reduction was the result of a very realistic and direct approach. Instead of specifications such as those written for monumental buildings and enforced by what are sometimes called the "razor-blade, mirror and marble boys," standards of design and construction, based on good commercial practice, were formulated and inspection—although thorough and efficient—was carried out for the good of the job and not for the glory of commas and semicolons in specifications. Secondly, all non-essentials were stripped from the design. Thirdly, prospective bidders were taken into the confidence of the owner, so to speak, by open meetings to discuss plans and specifications *before* bidding, to prevent errors and misunderstandings.

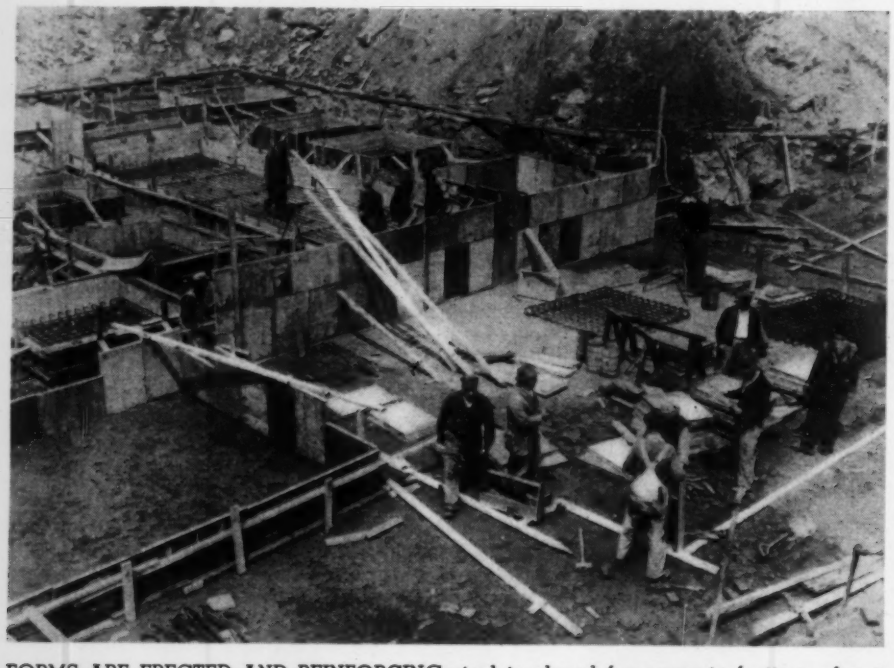
Results attained by a deliberate effort to promote good understanding between owner and contractor are quite interesting. Our practice of prequalifying bidders on major contracts made it safe for us before the war, when the construction market was stable, to eliminate the usual surety bonds, with a consequent saving of several hundred thousand dollars. Our practice of open discussions, continued past the bidding stage and throughout construction, has paid dividends too. Because of these factors, plus the most thorough



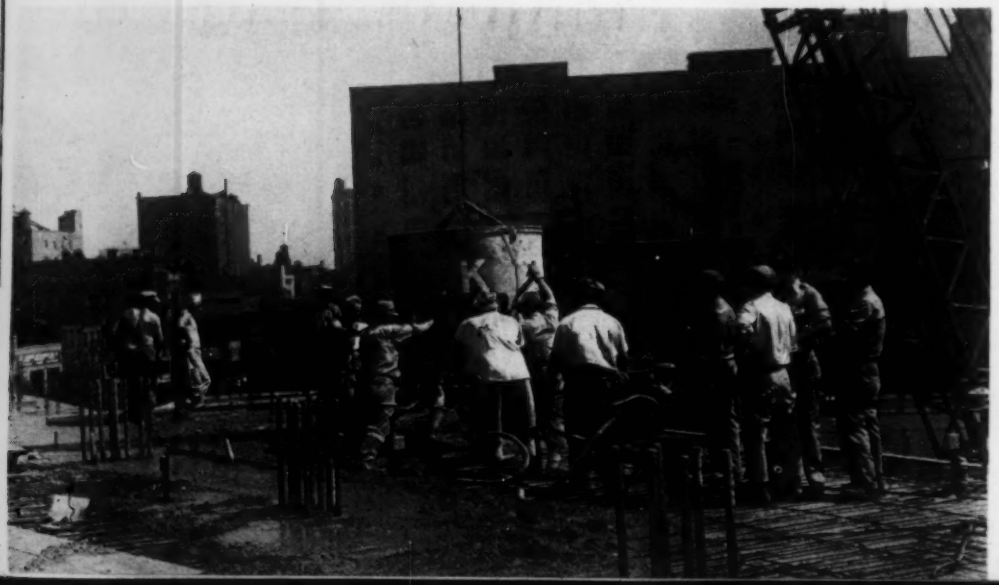
PILES AS LONG AS 100 FT (left), of composite type with 10-in. pipe for lower section, and regular Raymond spirally reinforced steel shell for upper section, are driven at site of Jacob Riis Houses on East River Drive between 6th and 13th Streets, Manhattan, N.Y.

CONCRETE FOR SPREAD FOOTINGS (below), and pilasters is poured from transit-mix truck by means of metal chutes at site of Elliott Houses.

CRANE WITH 145-FT BOOM completes concrete roof of 11-story unit of Elliott Houses. Plywood forms are used throughout these operations. Crane is Lima No. 802 rigged with special boom of 120 ft with auxiliary jib boom of 25 ft.



FORMS ARE ERECTED AND REINFORCING steel is placed for concrete footings of unit of Elliott Houses. Well points installed in this section lower ground water to elevation below bottom of footing excavation.



CRANE AND BOTTOM-DUMP bucket, 1-yd capacity, provide practical method of pouring concrete floor slabs. Method eliminates wheeling and building of runs for depositing concrete at proper locations. Crane is capable of pouring floors of buildings as high as 14 stories.

design and inspection, our record for cost of extra work up to the war has totaled less than one half of 1 percent on all the Authority's jobs, an unusually low figure for construction work of any kind.

Controlled Concrete Used

Economy, not cheapness, is stressed by the Authority in its construction work. There is no economy in housing in the use of poor methods or materials. From our actual experience both in construction and operation, the most economical standard for each element of construction is determined in advance; not one iota more than this standard is permitted to creep into the design and not one iota less than this standard is permitted in the construction, using the best materials and equipment available.

Our Authority was, so far as I know, one of the first organizations to use controlled concrete on a large scale. By controlled concrete is meant the preparation of design mixes before a job starts, using the same cement and aggregates which will be used on the job, and ascertaining accurately in advance just what will give the most economical results for the design strength used. This practice has so greatly increased the efficiency of our construction operations and is considered so important that we keep our own staff of trained concrete engineers. Controlled concrete is so economical that we use it for cellar floors, ramps, etc., where strength is not a factor and where plain concrete is normally considered cheaper. It brings double-barreled economy—first, in saving cement; and second, in saving space because of reduced size of members. It saves about $100 an apartment. And when apartments are built by the thousands, that saving mounts up.

We have no plastered ceilings. The emphasis on "quality" concreting makes it possible to get a perfectly presentable ceiling by painting the under side of the concrete floor slab. This saves another $100 an apartment exclusive of the saving in height of buildings by using this method of construction. Elimination of non-essentials such as closet doors saved

PRESENT ECONOMICAL HEIGHT of 14 stories for concrete frame construction is based on working limit at which concrete is efficiently placed by crane and bucket. Method is economical because same forms are reused for each floor, and ceilings do not require plastering after forms are removed. Controlled concrete is placed at specified strength of 2,500 psi for slabs and 3,500 psi for columns. High early-strength cement makes stripping possible in 24 hours.

at least $60 per apartment, even at prewar prices. We now use nothing but oversize brick. We cut corners so fine that even the metal door bucks come to the job with the metal saddle already welded to the buck to save separate installations at the job.

Building Codes Increase Complexity

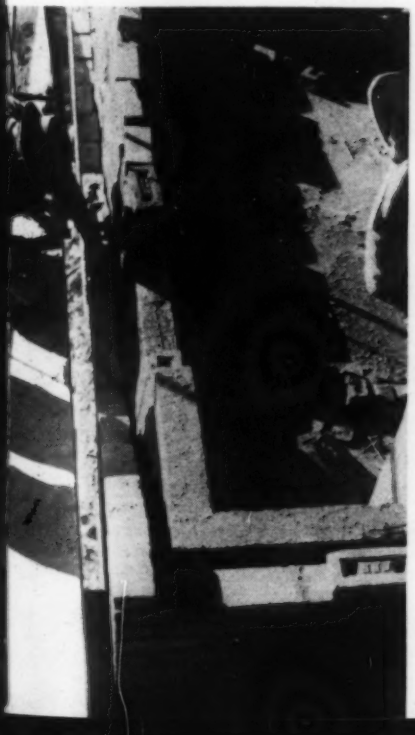
The problems encountered in planning and construction of large housing projects are very complex. In the first place, the existing New York City ordinances such as the Building Code and the Multiple Dwelling Law, under which we must operate, never contemplated large multi-block developments. In the second place, the very act of taking several city blocks —in the case of our Fort Greene Houses, there were 26 city blocks involved—out of the heart of a busy city, closing the streets and revamping the whole area, is a major undertaking by itself. It takes months alone just to work out the rearrangement of all the public and private utility lines which run beneath and above the surface. All of these studies and negotiations have to be carried on simultaneously with the design of the project itself, so that we have to start at least a year ahead.

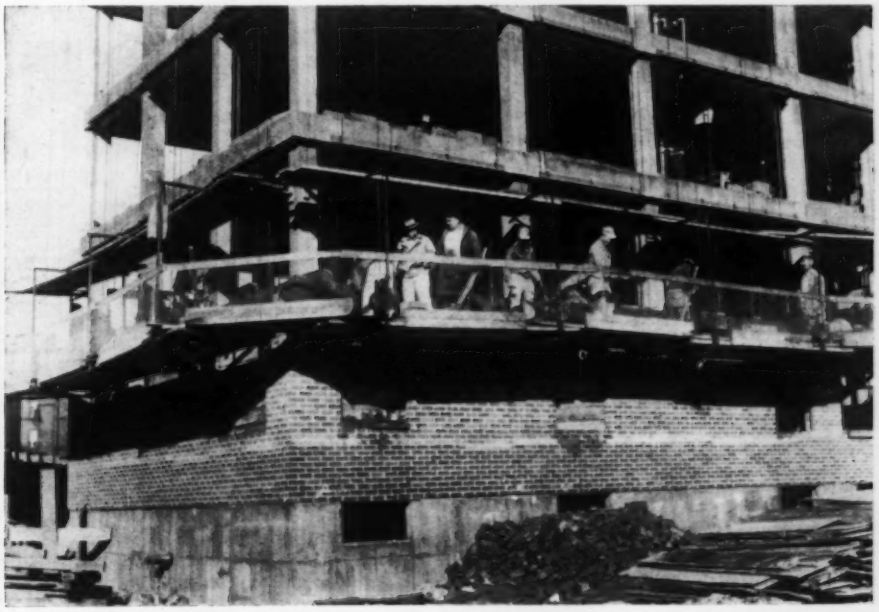
What have we learned in this process of evolution? The New York City Housing Authority has shown that fireproof housing, in large-scale operations, need cost no more than non-fireproof and can be built at even less cost. The Authority has also shown that it is more economical to build 6-story elevator-type buildings than the three- and four-story walk-up type previously considered to be the least expensive.

Wall-bearing construction was first used on the premise that it was more economical. After the first two jobs, skeleton-frame construction was tried as an experiment and was found to be just as economical, just as fast, and conducive to much cleaner construction operations. Over and above these factors, the war has since shown the greater safety of this type of structure in disaster.

As the program advanced, we began to get further into the heart of the slums. With land costs increas-

CAVITY WALL CONSTRUCTION (left) provides insulation for entire building, lessens weight and is more economical than other types. Cavity-type walls make building waterproof since any moisture gathering in walls is eliminated by weep holes placed in outer section. Cavity wall (right) consists of two sections. Outer section, one brick thick, is laid up in running bond with 2-in. air space to inner section of 4-in. cinder block. Two sections are bonded together with bronze ties, 2 ft 6 in. apart, embedded in mortar joints. Care is taken to keep 2-in. air space free of mortar and droppings.





ing and with soil conditions requiring costly piling operations, it became apparent that perhaps six stories were not enough to realize full economy. Considering the fact that on some of our projects the cost of piling alone is $1,500,000, it can be readily understood why so much was at stake. With some trepidation, and with social workers all over the country watching us (for apparently there was some theory that the higher the building, the more undesirable the social effect), we went to ten and eleven stories. It worked fine. On the next job we went to 13 stories and on some of the jobs we are about to start we will go as high as 14 stories.

Since our building frames are predominantly concrete, it is interesting to note that this present economic height of 14 stories is based on the working limit at which concrete can be efficiently placed by crane and bucket. The hoist and runway method disappeared from our operations years ago.

We hope to take bids soon on an 1,800-family project involving $14,000,000 in construction contracts, to be bid both in concrete and steel, with a complete set of plans for each. The project consists of 14-story buildings and we want to find out just where a height limit is reached at which steel may be more economical than concrete. In the design of a new 1,900-family project, all 16-story construction is being used to reduce the number of buildings and avoid interference with important underground utilities. Whether to make these buildings steel or concrete poses quite a problem, but lacking current comparative cost data, we have chosen steel because we believe the added two stories of height may tip the balance in favor of steel as the more economical type of framing at this particular site.

Space Planning Is Important

No one type of unit can be used to be the most desirable to meet every situation. The particular problems at each site, coupled with the types of buildings used, dictate different requirements. But in each instance the emphasis is on how space is used. The secret of economical housing construction is the efficiency—or even the frugality—with which space is planned. This basic premise cannot be overemphasized. We spend more time studying plans for economy of space than for any other aspect. If the central core of the building is made as compact as possible, the first hurdle has been taken.

The minuteness with which one must approach large-scale operations, in order to reap the fullest benefits, is exemplified by analyzing those parts of the building which involve *areas* primarily. For example:

- The exterior walls represent 17 percent of the cost of the building.
- The floors represent 20 percent of the cost of the building.
- The roof represents 4 percent of the cost of the building.
- The interior partitions represent 8 percent of the cost of the building.

These four parts total 49 percent, so that half the cost of the building is in these area factors alone—as distinguished from plumbing, heating, doors, elevators, etc. What this means is brought out clearly in the following example. We use 2-in. solid plaster partitions. If those partitions were $2^1/_4$ in., even though the partitions themselves cost no more, the cost of the increased area of floors, walls and roof, because of the additional $^1/_4$ in. would be the equivalent of 12 cents per sq yd of partition, and the added thickness would bring no advantages. For a $2^1/_2$-in. partition, the penalty would be 24 cents per sq yd—for a 3-in. partition, 48 cents. If you think these are small figures, consider the fact that for our average project they amount to $20,000, $40,000 and $80,000, respectively. For every penny saved in the cost per square foot of exterior walls, the saving per apartment is $4.50. For every penny saved in the cost per square foot of floors, the saving per apartment is $8.00. For every penny saved in the cost per square foot of roof, the saving is about $1.00 per apartment.

Concrete column dimensions are held to $11^1/_2$ in. square instead of 12 in. Why? Because an $11^1/_2$-in. column can be formed with one 4-ft width of plywood, but a 12-in. column cannot.

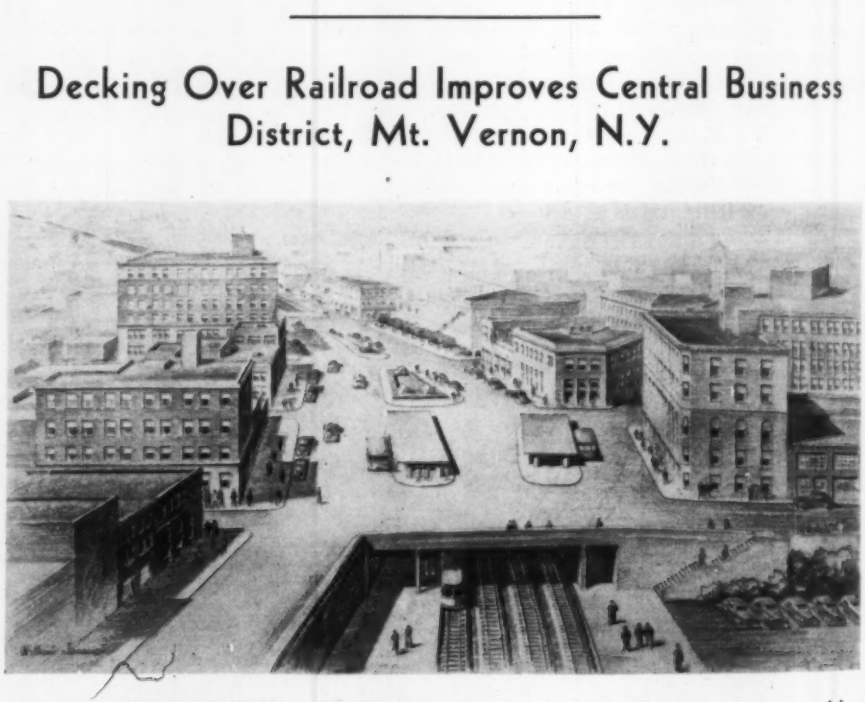
It is not necessary to make spectacular changes in design to save money. There is just as much gold to be extracted by concentrating on the factors just listed, even though when finished the building may look practically the same and the quality will not be impaired. The payoff is in the aggregate money saved.

No New Postwar Materials

The question has been asked whether we expect major changes in methods and materials of construction to evolve from war discoveries. The actual amount of wheat that can be sifted from the chaff of the glowing predictions of high-pressure salesmen, about the changes we would see immediately after the war, is disappointing. For example: Why

(*Continued on page 74*)

Decking Over Railroad Improves Central Business District, Mt. Vernon, N.Y.



IMPROVEMENT OF BUSINESS AREA of Mt. Vernon, N. Y., calls for construction of bus terminal and plaza extending from Third to Sixth Avenues over tracks of New York, New Haven & Hartford R.R. Area to be covered—roughly four blocks long by two blocks wide—is bordered by property assessed at $3,600,000. Plan evolved by Knappen Engineering Co. of New York, N.Y., meets all requirements for railroad clearances, etc., at cost of $2,123,000, exclusive of right-of-way. Design lends itself to construction in three stages to avoid major disruption of traffic and permit continuous use of railroad facilities.

Good Records Make Good Witnesses

OREN C. HERWITZ
Counsellor at Law, New York, N. Y.

ACCURATE, COMPLETE and meticulously maintained books, cost records, job progress and other daily reports of foremen, superintendents and others are essential to presentation of strong case in event of litigation.

IN APPROACHING the legal problems involved in what is termed "extra work," there arises the type of dispute in which the owner orders the contractor to do work as called for under the contract but which the contractor contends is not so required. Here the contractor has an option. He may refuse to comply, stop work, and sue for the value of the work already done; or he may comply under protest and later sue for the value of what he claims to be extra work.

The question thus presented to the court generally involves interpretation of the plans and specifications to ascertain whether the language used did or did not require the particular work to be done for the contract price. Such disputes rarely arise in the face of clear-cut language. The dispute in most instances is caused by ambiguities, omissions, and conflicts in the specifications.

Under these conditions it is understandable that the courts must apply the appropriate rules of contract interpretation, and particularly the one previously cited: "In case of conflict or ambiguity in the agreement, it is to be construed most strongly against the party who drew it, and any promise is to be construed in the way that the promisee had good reason to understand it."

If the court is required to apply this rule, the owner is likely to find two strikes against him when the contractor starts pitching in court. And if the court finds that the owner's engineer has actually misconstrued the language of the contract, not even that old familiar clause about the owner's engineer being the final arbiter on all questions arising under the contract will normally protect the owner.

HOW PARTIES to a contract make their own law was explained by Mr. Herwitz in an article published in the April issue of CIVIL ENGINEERING. In the following article he presents many valuable suggestions on the preparation of specifications and the protection of legal rights which, if followed, should prove helpful to both owner and contractor in avoiding the risks of litigation. Both articles are based on a paper read before a recent meeting of the Metropolitan Section of ASCE.

To minimize as far as possible the probability of this type of dispute, it is imperative that the owner's engineer use careful and precise language in the specifications to express what he has in mind. Regrettably, however, experience seems to indicate that engineers are often much less interested in the form of their specifications than in the substance. Their concern with substance rather than form is quite understandable; but it can, unfortunately, constitute a hazard to the owner's best interests.

To edit and reedit, to be sure that the words set down have a definite and precise meaning, to be certain that all necessary nouns, verbs, and punctuation have been included, may be a meticulous and dreary chore to an engineer who prefers to deal with rock, steel, and concrete. None the less, as court records will show, in serving his client's best interests, the art of expressing himself clearly and unambiguously may become as important a professional attribute to an engineer as the ability to design a solid foundation.

Armed with the knowledge that, in a contract case, the important question is not, "What intention existed in the minds of the parties?" but is, "What intention is indicated by the words used in the agreement?" the wise writer of specifications will learn to use precisely the right words and the right punctuation to express his ideas. Thus, a good dictionary and a

good grammar should become as standard a piece of engineering equipment as the slide rule.

Use Simple English

The possibility that a court may some day read your specifications does not mean, however, that legal words and phrases should be used. Far from it! They should be avoided like the plague, for they are words of art to be employed only by professionals who know how, when, and where to use them, just as words like "grouting," "berm," and "hardpan" are exclusively a part of the engineer's vocabulary.

The right language to use is plain, ordinary, everyday English. If a technical word must be used, make sure that it conveys the precise meaning intended. If there is any doubt that it will, do not use it. Instead, just imagine that you are writing your specification to be read by a judge or by a lawyer—which of course may be tantamount to suggesting that you say what you want to say in words of not more than one syllable!

A final caution must be stated at this point. If you must cover the same subject in more than one part of the specifications or contract, make sure that, in each instance, you use exactly the same language if you intend to convey exactly the same meaning. When different words are used to describe the same thing in different parts of specifications or contracts, too often the words require a different interpretation. This creates a conflict or ambiguity in your contract as a whole, which may land the owner in court or, at best, involve him in an unnecessary and expensive dispute with the contractor.

Means and Methods of Construction

In preparing specifications, the owner's engineer is normally tempted to do more than merely specify the end result to be accomplished. He very naturally feels a strong impulse to specify also the means and methods of reaching the desired result. While it is only human for an expert to believe that his is the best if not the only way to accomplish a given objective, to yield to this impulse without restraint is not always advisable from either the practical or the legal point of view.

Practically, it limits and restricts the contractor's initiative and it tends to narrow competition among bidders down to those who alone have the desire and the equipment to follow the method specified. To quote from ASCE Manual 8, *Engineering and Contracting Procedure for Foundations:* "The specifications need not refer to the methods of design and, in general, should not limit the contractor as to methods of construction. By confining the specifications to the results desired, the owner will benefit from the competitive methods of the contractors."

CONTRACTOR SHOULD NOT be limited as to methods of construction. By confining specifications to desired results, owner benefits from competitive methods of contractors. Shown here is particularly difficult section on Primary State Highway No. 12, between Skamokawa and Gray's River, Washington. In right foreground, diesel D7 tractor skids 3-ft concrete culvert pipe into position. Federal Aid Project contract of $254,000, held by Leonard & Slate, Oreg. Ltd., includes moving 300,000 cu yd of dirt in 2.76-mile road section.

Aside from this practical consideration, there are legal factors which make it hazardous to limit means and methods of construction, especially for the owner who hopes to hold the contractor responsible if the desired result is not accomplished. Ready to work against his hopes is a rule of contract law to the effect that the owner who prepares the plans and specifications is normally held to have assumed responsibility for their sufficiency to attain the required objective.

Here is a case in point. A contractor agreed in one part of a contract to follow the owner's specifications and, in another part of the same contract, expressly "guaranteed" that the floors would be waterproof. As it happened, the floors leaked and the ensuing dispute soon reached the ear of a court. Despite the contractor's express "guaranty," the owner lost. The Court construed the contract as a whole, which is in accordance with well-established principles, and interpreted the language of the "guaranty" to mean that the contractor promised to make the floors waterproof only if they could be made so by following the owner's specifications. It must be obvious that such a "guaranty" is hardly worth the effort of writing it into a contract.

If the owner intends to make the contractor guarantee the sufficiency of the plans and specifications, the use of anything but the clearest language is likely to cause a dispute which may result in a losing lawsuit. As has been previously pointed out: "Courts always avoid, if possible, any construction of a contract that is unreasonable or inequitable." Therefore, about the only way to hope for the aid of a court in enforcing such an inequitable provision is to show that the contractor himself has unequivocally accepted this risk by using language so clear and unambiguous as to admit of no possible doubt. Such a provision should frankly state that the contractor, having studied the plans and specifications prepared by the owner, is willing to and does guarantee that the finished structure which the owner desires can and will be constructed by following such plans and specifications.

Another danger involved in the specification of means and methods of

IN HIS ARTICLE titled "Parties to a Construction Contract Make Their Own Law," published in the April 1947 issue of CIVIL ENGINEERING, Mr. Herwitz emphasizes the importance of using language and punctuation that clearly express the intentions of parties to a contract.

construction, particularly in subsurface construction contracts, is the opportunity offered the contractor to claim that they constituted a representation of underground conditions. In one case a contractor successfully made this claim in court. He PROVED that the methods specified were appropriate only for the construction of a tunnel in free air, AND thereupon recovered the extra cost resulting from the fact that actual subsoil conditions required much compressed-air construction. And this result was reached despite a generally worded clause in the contract designed to protect the owner against this type of claim.

On the whole, then, it can be concluded that if disputes, litigation and costly disappointments are to be avoided, either the owner's engineer should restrain as far as possible his natural impulse to tell the contractor exactly how to do the work, or the owner should normally refrain from attempting to make the contractor responsible for the sufficiency of the plans and specifications.

Protecting Your Legal Rights

It is often an expensive disappointment to lose a lawsuit. But it is a particularly bitter pill if the case was lost because the loser did not do what he could and should have done when the dispute began. And this happens more often than it should. In too many cases the losing party has seriously prejudiced, if not destroyed, his chances to succeed long before he consults his lawyer. And by that time, the case may be damaged beyond the ability of even the most learned legal luminary to repair.

Yes—Franklin's adage about the "ounce of prevention" applies most forcefully to the parties who, with the contract signed, are now engaged on the construction phase of a project. Here, the "ounce of prevention" is to make a complete, written record of the facts involved when a contract dispute arises.

As an illustration, consider the contractor who omits to make a written protest before proceeding to perform work which he regards as outside his contract requirements. Later, in court, though he may present witnesses who swear he made such protest orally, the jury is not obligated to and may not believe them. If they do not, his claim will be lost, because the law prescribes such protest as a condition precedent to the pressing of a claim.

A promptly written letter of protest would have provided stronger and probably conclusive proof that this imperative step, the protest, had been taken when it should have been taken. And, in connection with the mention of "strong testimony," it is well to remember that judges and juries, like the rest of us, believe that pictures, like figures, don't lie. Therefore, it is wise to take photographs whenever possible to show the exact nature of the work or job condition which is the subject of a legal dispute. Remember that if the case goes to court, the jury may be composed of the butcher, the baker, and the candlestick maker. Knowing nothing of construction problems, they are much more likely to "get the picture" from a photograph than from a parade of witnesses and a volume of testimony.

The legal requirement of notice in writing, however, is not confined to claims for extra work. In construction contracts, other types of written notice are frequently made a matter of express contract obligation to which both owner and contractor are often subject. Examples are the order to proceed with the work, the order declaring the contractor in default, the notice of injury to persons or property, the application for an extension of time, the order for extra work, etc.

Requirements to "put it in writing," such as the notice to begin work, the application for extension of time, the order for extra work, etc., are generally clearly written into the contract. Yet it is surprising how often the parties fail to comply strictly

(*Continued on page 76*)

World's Largest Stair Installation

THREE HOUSING PROJECTS, being built in New York City by the Metropolitan Life Insurance Co. to house 70,000 people, require largest stair installation project ever undertaken. Two of these projects pictured here (above), Stuyvesant Town in foreground and nearly completed Peter Cooper Village in background, cover 27 city blocks of Lower East Side of Manhattan. Third project, Riverton, covers six city blocks of Harlem. Stairs (right), 3,290 of which are required, are constructed of Jones and Laughlin Steel Corporation's Junior Channels and Jaltread floor plate. Stairs are used during erection of buildings.

City Planners and Business Leaders Must Guide Communities' Economic Growth

NEWTON C. FARR

President, Urban Land Institute; and Chairman, Committee on City Planning and Related Activities, Chamber of Commerce of the United States, Washington, D.C.

THERE IS A VERY IMPORTANT PLACE for the civil engineer in the city planning program. In the first place, he is a citizen and should be active in the affairs of his community. He should take an interest in legislation necessary to carry through a program of land assembly and redevelopment. He should have a part in the planning of these areas, including not only the buildings for private use, but the public buildings, parks, playgrounds, and recreational areas. There is a large job alone to be done in the replanning of existing public utilities in an effort to conserve the maximum of the facilities already in place and at the same time to expand them or rebuild them for future use. It is necessary to give consideration to transportation to serve these communities, such as the opening or widening of streets and boulevards, the layout for passenger-automobile, truck, bus or surface-car transportation systems, and the parking of automobiles.

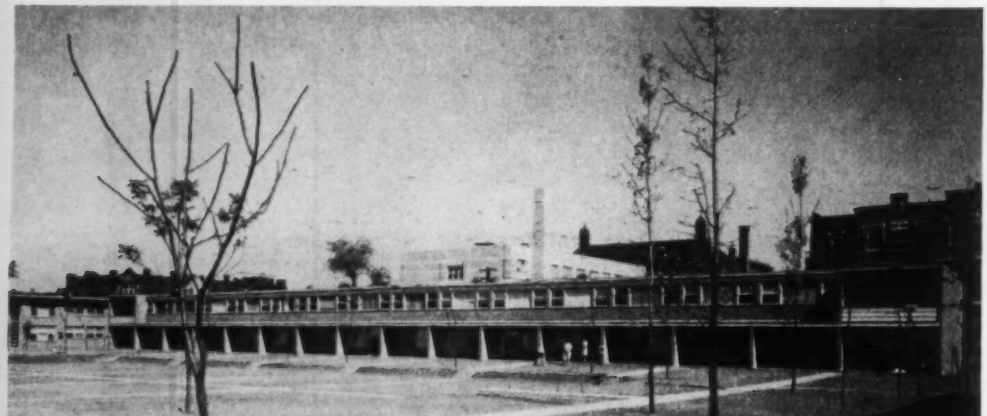
WITH THE GROWTH of our American cities, there have accumulated many problems which affect seriously the older areas which have gone through a period of transition from their original development. Most of our cities were built without a general plan and expanded by the addition of new communities as the needs of the population demanded. In those days, there were no trained city planners, and the real estate men who subdivided and sold the land had not had the benefit of the experience and education that are readily available today. The business section was generally located at a point determined by the highway, water or rail transportation which connected the community with other neighboring towns.

Generally the residential area surrounded or partially surrounded this business district. Industry followed the lines of transportation. As the city grew, the residential areas were expanded farther and farther away from the business center and eventually required new outlying business districts to serve the daily needs of the residents, who did not wish to come all the way downtown to do their shopping. As business and industry expanded, they did so generally into the residential areas, which became less attractive as homes for those who could afford to live in better neighborhoods. In this way there developed many of the blighted areas with which we are concerned today.

Most Cities Have Plan Commissions

Most of our modern cities have established plan commissions which have studied the needs of the city in an effort to guide future development. The City of Chicago developed a plan in 1909 under the direction of the Commercial Club. This plan was prepared by Daniel H. Burnham and Edward H. Bennett, architects, and has been the means of guiding splendid improvements in the way of parks, boulevards, street widening, railroad terminals, and other projects which have done much to bring credit to the City of Chicago.

In general, until recently the plans have not given proper consideration to the redevelopment of blighted areas. Some of these areas have sunk to a point where they are not suitable for the habitation of any American citizen. However, it has been my experience that most of these areas are made up of buildings of all types—dilapidated old houses; other residences which are still habitable but blighted by reason of the surround-



CITY PLANNERS and business leaders have responsibility of correcting and improving communities that have become blighted. George Washington Carver Gardens fronting on interior court (top) is solution to housing problem in crowded section of Chicago. Bottom view shows 4-apartment buildings in same housing unit at left, and rear of row housing at right.

ings; old flat buildings which are unsafe and unsanitary; other flat buildings which are sound structurally and susceptible of rehabilitation; stores which are occupied by inferior tenants at extremely low rentals; other stores which are prosperous and able to pay moderate rentals; and interspersed with these properties, industrial buildings which tend to make the neighborhood undesirable for residential purposes. All of these conditions affect the city in various ways:

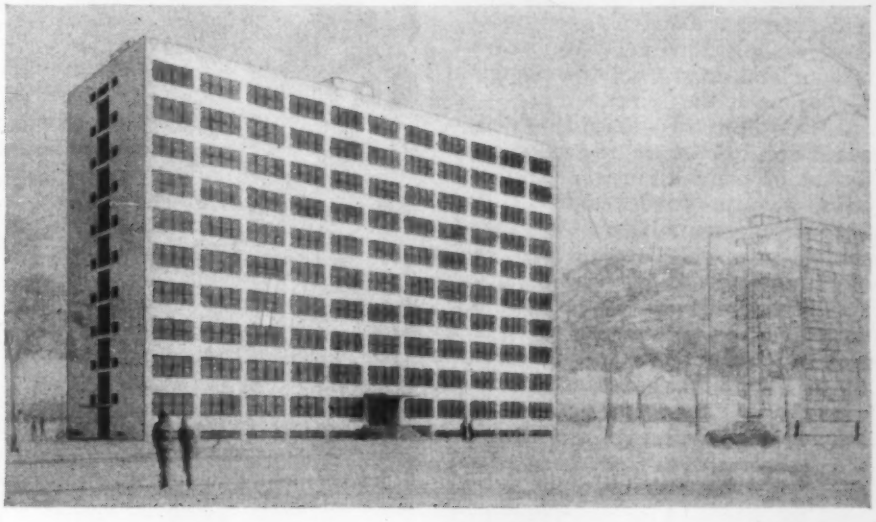
1. The decrease in real estate values brings a reduction in the amount of taxes that can be collected from the community. Included in this is an increasing amount of tax delinquency which brings on the problem as to how to enforce the payment of taxes or what the city should do with the property if the taxes are not paid.
2. The cost of police and fire protection, together with other municipal services, is greatly increased.
3. The surrounding territory, which becomes less desirable, is gradually affected in the same way.
4. Retail business in the central business district is affected by the lower purchasing power from the blighted area and the exodus of the more prosperous residents to more remote sections of the city.
5. The general moral conditions of the residents in the community is affected and stimulates radical economic and political activity.

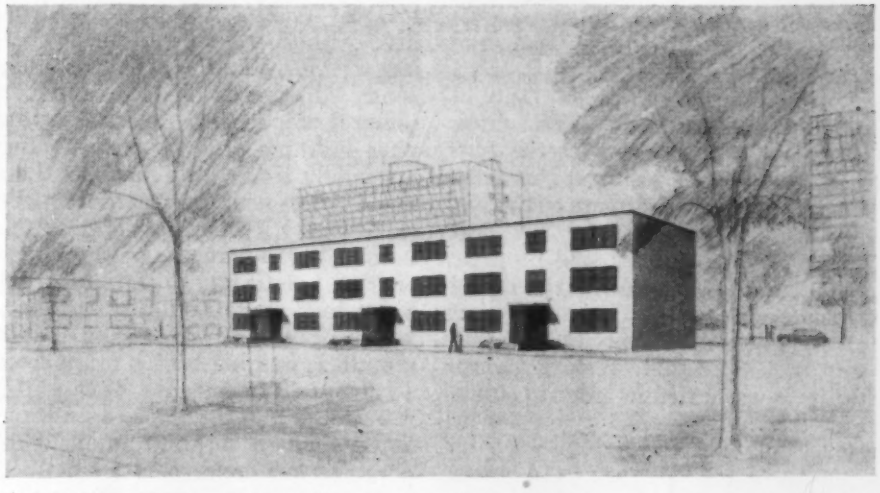
Business Leaders Have Responsibility

It therefore becomes important to the business leaders of our communities to see that something is done to correct and improve these communities. It is essential that they not only give their very best efforts to replanning and redevelopment but that they support these plans financially, and liberally. The responsibility for this support should go to those who live in the outer sections, or even outside of the city, and who depend on the city for their livelihood or their cultural and social activities.

There are a number of steps to be considered in the redevelopment of these areas:

1. It is essential that health and safety regulations be enforced in these areas. This means that unsanitary and unsound buildings be either wrecked or rebuilt in order that they may comply reasonably with proper city ordinances. Here I think it is well for our cities to re-study their ordinances carefully in order that they may be brought up to date, to permit the best use of design and materials.





PLAN DEVELOPED in 1909 in Chicago is guide for many improvements to city. Recent plans consider redevelopment of areas that have sunk to point not suitable for habitation. Top view shows Illinois Institute of Technology campus, and vicinity prior to redevelopment program. Center view is artist's sketch of 10-story apartment building to be constructed by Institute on northwest corner of 32nd Street and Wabash Avenue. Bottom view is sketch of 3-story building of type to be erected on campus.

Consideration must be given to the owners of old buildings who cannot comply with ordinances which force unnecessary building alterations. Consideration must also be given to the fact that thousands of buildings which must be wrecked are now occupied as homes by people unable to locate elsewhere.

2. The city should set up a plan which will contemplate the ultimate redevelopment of all of these areas. This means that a careful study must be given to rezoning in certain of these sections. In studying this rezoning, careful consideration must be given to the existing structures within the area in order that there may eventually be a minimum destruction of existing buildings which do not conform to the future plan. Careful consideration should be given to the method under which structures that do not conform to the plan can be gradually eliminated or reconverted. We must remember that if our cities continue to grow, our planning must also be continuous and must meet the changing conditions as they come.

3. Certain areas should be designated for immediate redevelopment by the proper authorities. To carry out a program of redevelopment, it is of course essential that ways and means be provided for the assembly of the land which is to be replotted and rebuilt. It is possible that the owners in a given area can agree to a plan which they will carry out without the need for public assistance. Otherwise it is important that some branch of government, some institution, corporation or trust, be provided the means for the assembly of the land to be resold for redevelopment under the plan. Many of our states have set up redevelopment laws.

New Housing Needed

Aside from the great importance of rebuilding older sections of our cities, there is the great need for the construction of new housing at this time. This is considered by many as the No. 1 problem in America today. A great deal of new housing should properly be built in the blighted areas described herein. Any public assistance that can be given in the way of land subsidy or cooperation of local governments is warranted in order to stimulate this much-needed type of construction. The areas designated for redevelopment are generally easily accessible to the large number of persons who work in our central business districts so that the problems of transportation for these workers would be minimized. Many of them would be able to walk to their work, thus eliminating traffic congestion from automobiles or overloading of local transportation systems.

The buildings to be built in these areas should in general be for rental housing. There should be large and small buildings well diversified with apartments ranging from minimum size to those large enough to accommodate larger families. There should also be single-family dwellings to take care of those who wish to occupy their own homes. It has been my experience that there is a tremendous demand at this time for the purchase of small homes in redeveloped areas. By reason of high land costs and the necessity of conserving land, many of these homes should be of the row housing type, or what we like to call "group housing." There should also be detached housing where sufficient land is available, that is, an area with a variety of residential buildings which would make up a well-rounded community.

Something New in Lighting and Air Conditioning

MORE THAN 150 DESIGNING ENGINEERS in this recently enlarged Cleveland District drafting room, adjacent to The Austin Co.'s general offices, find that the room's new lighting and air-conditioning materially reduce the strain of their work. Recessed, fluorescent troffer units on 3-ft centers, extending the length of the room between the welded rigid-frame arches, are equipped with daylight and soft-white tubes of 40-w intensity. With mounting heights, which range from 13 ft near the outsides of the 70-ft span to 22 ft at the peak, a uniform, well-balanced lighting intensity of over 90 foot-candles is maintained on the drafting tables. The troffer units are suspended from the purlins, and the metal acoustic ceiling is supported by these lighting fixtures. Three lines of air-conditioning supply ducts are located on each side of the room toward the outside of the span. These extend the length of the building, and are supported on the rigid-frame arches between the purlins. A space between the four lines of purlins in the high center section serves as a return air duct. Air-conditioning machinery, housed in a small two-story equipment building adjoining the drafting room, includes a fan room designed to handle 35,000 cfm. A new type of electrostatic filter, which applies an electrical charge of between 6,000 and 9,000v to filter paper, is installed on the second floor across the entrance to the plenum chamber. Reciprocating refrigerating compressors of 100-ton total capacity are installed on the first floor, with evaporative condensers and other auxiliary equipment. Steam for heating is supplied by the existing boiler plant.

Engineers' Notebook

Design Constants Facilitate Analysis of Beams Composed of Prismatic Segments

HARRIS SOLMAN, M. ASCE

Senior Highway Bridge Engineer, U.S. Public Roads Administration, Albany, N.Y.

RAPID DEVELOPMENT of reinforced concrete in bridge construction and the introduction of curved beams with gradually varying sections has for a long time intrigued structural designers and stimulated their efforts toward the advancing of ingenious methods and short cuts for determining the design constants of such beams. But the usual steel beams composed of segments of different prismatic sections still are and will undoubtedly always remain in common use. Yet very little attention has been devoted toward facilitating the analysis of such beams as parts of a system of continuous beams. These are beams in which the various segments are formed by splicing of different sections or, more commonly, by the addition of cover plates of varying lengths. An attempt is made here to express the design constants of such beams as simple, easily applied formulas in terms of the elements of the sections of their analogous columns.

Elements of Section of Analogous Column

The concept of the analogous column was first introduced by Prof. Hardy Cross, M. ASCE. The analogous section corresponding to any structural member is a section formed by the neutral axis of the member and a depth at every point equal to the reciprocal of the moment of inertia of the member at that point (or the reciprocal of the product of the moment of inertia and the modulus of elasticity, where the latter is also variable). For beams of prismatic segments, the analogous column section is a series of rectangles, as shown in Fig. 1, and the elements of that section can easily be computed.

The elements of the analogous column section are:

a = area of the section

m_A (or m_B) = static moment of a about support A (or B)

i_A (or i_B) = moment of inertia of a with respect to A (or B)

i_a = moment of inertia of a with respect to its gravity axis.

Note that small-type letters are used to denote the elements of the analogous column section to distinguish them from those of the sections of the prototype.

Beam Constants

The beam constants are as follows:

Carry-over from A to $B = r_A =$

$$\frac{Lm_A - i_A}{i_A} = \frac{Lm_A}{i_A} - 1$$

where L = beam span.

Stiffness at $A = K_A = \frac{i_A}{ai_a}$

Beam and Load Constants—Fixed-End Moments

Single concentrated load P:

Let

x_A = distance between point of application of load and support A.

x_B = distance between point of application of load and support B.

a', m'_A, and i'_A (or m'_B and i'_B) = values of a, m_A, and i_A (or m_B and i_B) respectively of portion of section between A and point of application of load.

a'', m''_A, and i''_A (or m''_B and i''_B) = values of a, m_A, and i_A (or m_B and i_B) respectively of portion of section between point of application of load and B.

Then, for a fixed condition at B,

$$F_A = -\frac{i_A(m'_A + x_A a'') - m_A(i'_A + x_A m''_A)}{ai_a} \cdot P$$

and, for a hinged condition at B,

$$F_A = -\left[\frac{L\,(i''_B + x_B m'_B)}{i_B} - x_B\right] P$$

For a symmetrical beam (fixed both ends) with a concentrated load at the center,

$$F_A = -\frac{m'_A}{a} P$$

Uniform load, w lb per lin ft, over entire span:

For a symmetrical beam (fixed both ends),

$$F_A = -\left(\frac{L^2}{8} - \frac{i_a}{2a}\right) w$$

and in general for any beam.

For a fixed condition at B,

$$F_A = -\frac{m_A j_A - i^2_A}{a\, i_a} \cdot \frac{w}{2}$$

and for a hinged condition at B,

$$F_A = -\left(L - \frac{j_B}{i_B}\right) \frac{wL}{2}$$

The last two formulas contain a new section element, j. This may be termed the "third area moment" and

(*Continued on page 76*)

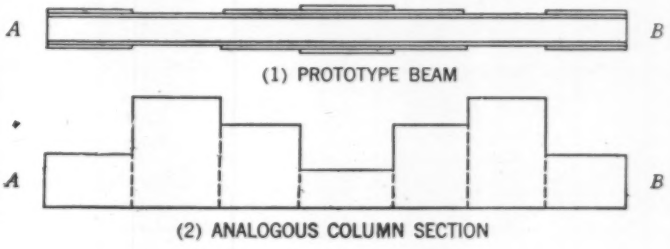


FIG. 1. FOR BEAMS OF PRISMATIC SEGMENTS, analogous column section is series of rectangles.

...THE READERS Write

Canadian Member Favors Dues Increase

DEAR SIR: Canadian members of the American Society of Civil Engineers should hesitate about offering a solution for the growing pains of the Society. Nevertheless, I am going to run the risk of criticism.

Judging from the March CIVIL ENGINEERING, the Society must face up to an early move to secure additional income if its activities are not to be curtailed. I am sure that we Canadian members will, to a man, support any constitutional changes that may be necessary to provide for an increase in annual dues, which will enable the Society to continue its leadership among the organized engineering bodies on this continent.

When a similar situation arose in the Engineering Institute of Canada, its council decided to submit by-law amendments that would permit of increased fees. These amendments were supported strongly by every past-president. A brief and timely request from them for the support of the by-law changes proved an important factor in their adoption by a large majority. One feature of the situation that gave the past-presidents a great deal of comfort in their campaign for adoption of the amendments was the very generous and widespread support which came from the members of the Institute resident in the United States.

May I suggest that a prompt and bold attempt be made to secure the necessary constitutional amendments that will provide the ASCE with increases in annual dues and permit it to continue to function for the profession with distinction and success?

The ASCE flag must be kept flying on both sides of the international boundary with all its accustomed glamour and prestige.

J. B. CHALLIES, M. ASCE
Montreal, Canada

Delft School Suggested for European Study

DEAR SIR: I have read with interest Hunter Rouse's letter, in the February issue, regarding the opportunities available for graduate study in engineering in Europe. While Dr. Rouse had particular reference to the field of hydraulics and did not imply that the three schools he named were the only ones which should be considered, I believe that in fairness the Technische Hoogeschool of Delft, in Holland, should be mentioned.

The Delft School, formerly the Royal Polytechnic, is the national engineering college of the Netherlands. Because of Holland's geographical position, the study of hydraulics has always been important at Delft and a strong department has been developed in this field. The laboratories, under Prof. J. Th. Thijsse, compare favorably with any in Europe and are being operated at capacity on research problems. The facilities in physical engineering (a relatively new division combining physics and engineering) are worthy of mention, as are the courses in planning given by the schools of architecture and civil engineering.

Although completely closed by the Germans during the occupation, the school has made a remarkable come-back. Besides an enrolment of over 5,000 students, the school has been assigned a key position in "T.N.O.," the government-sponsored applied scientific research organization, and its activities are a symbol of the determined efforts that are being made by Holland to be a world leader in the field of science and industry.

The fact that the official language of the school is Dutch has, in the past, limited the number of foreign students attending Delft. For graduate fellows, however, this should not be a deterrent as the faculty in general speak not only English, but also French and German fluently.

I can heartily endorse Dr. Rouse's recommendation of Europe as a field for graduate study in engineering. It is, I think, unfortunate that, in the past, so little opportunity has been provided for American engineers to work here. Those able to come will find not only a high standard of technical excellence but a very warm welcome.

JOHN A. LOGAN, Assoc. M. ASCE
Eng. Representative, International Health Div., The Rockefeller Foundation
Paris, France

Simplified Solution for Vertical Curve Suggested

DEAR SIR: In recent issues I have noticed several solutions for computing vertical curves, and was especially interested in the method suggested by N. W. Pettijohn, in the February issue. His solution is rather laborious and can be simplified by the following method, which was used by the Canadian Pacific Railway some thirty or forty years ago.

Example: Using the same terminology as Mr. Pettijohn—namely, a minus 2 percent grade intersecting a 4 percent grade at Sta. 563+00, the elevation of the grade intersection point being El. 569.30, and using a 1,000-ft vertical curve—the B.V.C. would fall at Sta. 558+00 and the elevation would be El. 579.30 and the E.V.C. would fall at Sta. 568+00 and the elevation would be El. 589.30.

Solution: Rate of change =

$$\frac{\text{Algebraic difference in grades}}{\text{Length of curve in stations}}$$

Rate of change for example =

$$\frac{2.00 + 4.00}{10} \div 0.60$$

For setting the first station from the B.V.C. only half the rate of change is used, and for all succeeding stations the full rate of change applies.

STATION	COMPUTATION	GRADE ELEVATION
558 + 00		579.300
	2.00 − 0.30 =	−1.700
559 + 00		577.600
	1.70 − 0.60 =	−1.100
560 + 00		576.500
	1.10 − 0.60 =	− .500
561 + 00		576.000
	0.50 − 0.60 =	+ .100
562 + 00		576.100
	0.10 + 0.60 =	+ .700
563 + 00		576.800
	0.70 + 0.60 =	+1.300
564 + 00		578.100
	1.30 + 0.60 =	+1.900
565 + 00		580.000
	1.90 + 0.60 =	+2.500
566 + 00		582.500
	2.50 + 0.60 =	+3.100
567 + 00		585.600
	3.10 + 0.60 =	+3.700
568 + 00		589.300

If it is required to locate the intermediate 50-ft. points, proceed as follows: Rate of change for setting points at 50-ft. intervals becomes $\frac{2.00 + 4.00}{2} \div 20. =$ 0.15 R. of C.

Station	Computation	Grade Elevation
558		579.300
	1.00 − 0.075 =	−0.925
+50		578.375
	0.925 − 0.150 =	−0.775
559		577.600
	0.775 − 0.150 =	−0.625
+50		576.975
	0.625 − 0.150 =	−0.475
560		576.500
	0.475 − 0.150 =	−0.325
+50		576.175
	0.325 − 0.150 =	−0.175
561		576.000
	0.175 − 0.150 =	−0.025
+50		575.975
	0.025 − 0.150 =	+0.125
562		576.100
	0.125 + 0.150 =	+0.275
+50		576.375
	0.275 + 0.150 =	+0.425
563		576.800
	0.425 + 0.150 =	+0.575
+50		577.375
	0.575 + 0.150 =	+0.725
564		578.100
	0.725 + 0.150 =	+0.875
+50		578.975
	0.875 + 0.150 =	+1.025
565		580.000
	1.025 + 0.150 =	+1.175
+50		581.175
	1.175 + 0.150 =	+1.325
566		582.500
	1.325 + 0.150 =	+1.475
+50		583.975
	1.475 + 0.150 =	+1.625
567		585.600
	1.625 + 0.150 =	+1.775
+50		587.375
	1.775 + 0.150 =	+1.925
568		579.300

The above figures for grade points on the vertical curve check with the figures in Mr. Pettijohn's example. I might add that by using the method of calculation I have shown, there is a check on the figures as the E.V.C. Elevation has to agree with the one calculated from the P.I. of the curve.

W. B. Crombie

Glasgow Station, Canada

Cites Some "Bugs" in Structural Welding

To the Editor: I was much interested in Mr. Lincoln's letter on the subject of arc welding in the November issue.

One objection to the use of welded designs for trusses is that the individual members cannot be "set" or given initial "twist" of predetermined amounts sufficient to counteract secondary stresses. This accepted procedure is in addition to providing camber in shop fabrication. In riveted design, this objection is obviated by rotating the line of drilled holes for each rivet group the predetermined amount and direction and forcing the member into position by the use of drift pins. After riveting, the drift pins are withdrawn. Some method might be worked out for attaining the same result with welded trusses. It would probably involve drilling extra holes and the use of drift pins. After welding, the drift pins could be withdrawn and the holes plug welded. Studies of secondary stresses as related to ultimate failure would be in order.

Consider the possible failure of one member in a structure composed of a great many members, with each subject to stresses of varying amounts. In a riveted design the connections will yield, thus redistributing the stresses throughout the structure before overstressing individual members to the point of yield or to the point of ultimate failure. A welded design does not afford the same safety here, although yielding of individual members may effect some sort of redistribution before ultimate failure.

With reference to the advertisement on page 5 of the November issue, what if a crack should occur in the welded design as a result of momentary overstress impact, etc.? Notch effect could cause continuous progressive failure across the joint and section itself. Such failure is usually stopped with a riveted joint. Additional stiffening ribs and diaphragms help to prevent notch effect and progressive failure. Low working stresses for parts subject to notch effect and progressive failure are also advisable. The relative economy of a proportionately safe and acceptable welded structure, particularly for unusual loading conditions, is hence still subject to question in this transition period from riveted to welded design.

To demonstrate notch effect and progressive failure and to illustrate how they can supersede other conceptions of safety factors, make the following simple experiment. Take a strip of cellophane as a material available to all and for which no more elaborate testing machine than yourself is needed. Notice it is difficult to break a strip of it in direct tension. However, place a small cut transverse to the stress and the cellophane will part under the same direct tension with almost no resistance. Notch effect and progressive failure are strikingly illustrated by this simple test. Of course, steel is a material with different physical characteristics from cellophane, and yet notch effect and progressive failure have occurred in several important structures.

The strength decks of several welded ships have, in some instances, parted with thunderous reports without any forewarning, breaking the vessels in two. One Canadian shipyard is producing hulls welded below the water line and riveted above the water line. Although they attribute this to lack of welding facilities, it is a little more than coincidence that they have arrived at a happy balance in so far as beam strength and notch effect are concerned. The welded hull below water is only lightly stressed in tension and is ideal for lowered skin resistance or streamlining. The riveted hull above water, which is heavily stressed in tension in the "hogging" condition, is protection against the occurrence of serious notch effect and progressive failure. Such "happy balances" as the foregoing might well be achieved in land structures built of steel.

In due time, most of the problems encountered in the design of structural welding and the fabrication and erection of heavy sections will be reduced and formulated in acceptable specifications.

Charles W. Dohn, Jun. ASCE

New York, N.Y.

Welding and Riveting Held Not Competitive

To the Editor: Advertisements are too often prone to be overly aggressive, to say the least. Yet new processes have to be overemphasized to receive attention and to wear down precedents. In the current discussion, neither the advertisement on Page 5 of the November issue of Civil Engineering, nor Mr. Lincoln's letter in the same issue, nor Mr. Dohn's letter in this issue, tells the whole story in regard to the relative merits of arc welding and riveting. Brief and incomplete discussions can, by their very nature, present only portions of the facts. Therefore, even though facts are used, erroneous conclusions can be drawn. Such statements as, "Welding over the years has done a more reliable job than the rivets it has replaced" is indeed a bold statement.

The practicability of welding as a means of making structural connections can today stand on its own record. This remark is made in full knowledge of certain failures in welded connections. But have there not also been failures in riveted connections? The structural engineer should not view welding and riveting as competitive processes, but rather as two useful methods for making connections. The selection of either process should be made on the basis of the conditions of the problem and the decision made as a result of technical reasoning rather than the routine acceptance of one or the other school of thought. This point of view is consistent with the engineer's accepted and proved approach to the solution of the problems, for which he is professionally responsible.

As to relative costs, until each structural designer is able to secure cost data that reflect every item involved in both riveting and welding, including not only the obvious items but those that deal with capitalized annual costs of equipment, design, fabrication, erection and labor, there will be a great deal of unfounded

argument that can be quite misleading to those who have a right to expect dependable counsel from the members of the construction industry.

Now that welding has rightfully been established as one means for making structural connections, not in every case but in many carefully considered situations, why not switch the effort and emphasis *from competition* between riveting and welding *to comprehensive and coordinated research?* The pioneer days for structural welding are over. Why not assemble the skill of the industry under such an agency as, for example, a Welding Research Institute?

The primary function of such an institute would be to assemble personnel who are able to conduct reliable research programs; coordinate, on a national basis, the work of other investigators both in the past and in the future; and disseminate results systematically and periodically so that the profession may devote its energy to constructive progress as compared with energy-consuming claims and counterclaims. It might even be desirable to assign to such an institute the purpose of studying, on an equitable basis, both the riveted and welded types of connection.

FRANK KEREKES, M. ASCE
Prof., Structural Eng.,
Iowa State College

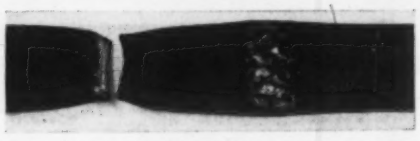
Ames, Iowa

Claims Welding Process Unnecessarily Handicapped

TO THE EDITOR: There is one controlling fact regarding welded structures, which, from a practical point of view, makes criticism of the welding process nonsensical. That fact is that in the case of mild steel, which embraces more than 95 percent of all the welding that is done, the welded joint is very much stronger and has a very much higher elastic limit than the plates joined. Thus the weld can never be used in actual service at anywhere near its point of failure. As a matter of fact, in actual application, if the welded structure should be loaded to a point that would even approach the elastic limit of the welded joint, or the metal immediately adjacent to the weld, the structure itself would be useless.

Assume, for instance, there is a chain of 100 links, with each link made of 1-in. round, 99 of the links made of mild steel, and one link made of high-strength alloy steel. In testing the chain, would anyone worry about a break in the one alloy link? No, because every one of the other 99 links would break long before the alloy steel link was even partially loaded.

Exactly the same thing is true of a welded structure. The weld itself and the metal immediately adjacent to it have an elastic limit 50 percent above that of the parent metal and an ultimate tensile strength at least 20 percent greater. If the strength of the rest of the structure is



TENSILE SPECIMEN CONTAINS WELDED JOINT with abundant surface porosity. Specimen failed in plate at 59,100 psi.

sufficient, certainly the weld must be. As a matter of fact, structures are designed with a factor of safety, so that at its maximum load the structure would not be up to one-half the elastic limit of the parent metal. Obviously, it would not be stressed to more than one-third the elastic limit of the weld metal and the plate immediately adjacent to it.

Because of the constant criticism of welding, great and unnecessary expense is put upon the manufacturer using the proc-

TENSILE SPECIMEN CONTAINS WELDED JOINT with abnormally large amount of internal porosity. Tensile specimen failed in plate at 62,500 psi.

ess. This, of course, is paid by the buyer in higher prices. Neither reason nor any possible return accrues to the user. Countless illustrative cases can be cited. For example, if there is surface porosity, even so much as a little hole on the surface, the weld is rejected. If that same little hole were below the weld surface where it could not be seen, the manufacturer would have to cut it out carefully and reweld the joint, at great expense, after finding it with expensive X-ray.

TENSILE SPECIMEN CONTAINS WELD WITH abnormal amount of undercut. Specimen failed in plate at 59,400 psi.

Again, if there occurs slight undercutting at the edge of the weld, the weld must be re-welded and the slight undercut eliminated.

Perhaps we could understand such rules, if they were not made by engineers who obviously know the facts. However, all such rulings are made by men who insist they are experts in the profession of arc welding.

The accompanying illustrations show again the obvious facts. They present proof of all the foregoing statements regarding the efficiency of welded seams with so-called defects. One shows an extreme example of porosity, yet the joint is stronger than the plate. Another shows great undercut and even laps in the weld that still break the plate in tension. Not only would such joints be rejected, but if they had 1 percent of these so-called defects the structure itself would be rejected.

It is perfectly obvious that a riveted joint could not join any of these pieces of steel together so that, under tension, they would not break. However, there is no testing of the rivets, no X-ray of the voids in their joint, no elimination of the undercut, although we know that all of these defects are present in every riveted joint. Again I ask the obvious question, "Why accept such defects in a riveted joint and reject them in arc welding with its greater strength, ductility, and soundness?"

There is no doubt that if foolish restrictions, which can add nothing whatsoever to the success of any welded joint, were removed, the cost of welding such structures could be reduced by as much as 90 percent in many cases. Yet because of these restrictions, concurred in by many engineers, the industry paid hundreds of millions of dollars in additional costs over the years, with no increase in safety and no betterment of the product from any point of view.

These attempts to discredit a tremendously valuable manufacturing process, which contributed more to the winning of the war and to the production of a higher standard of living than almost any other recent mechanical development, must be stopped.

J. F. LINCOLN
President, The Lincoln Electric Co.

Cleveland, Ohio

Fluid Polariscope Aids in Hydraulic Studies

DEAR SIR: The material presented by Dr. D. B. Steinman in his symposium on "Aerodynamic Characteristics of Bridges," in recent issues, is very interesting. The forces developed on a body by the fluids flowing past the body are almost unknown as compared with such items as the dead and live loads. The determination of these forces and proper use of this knowledge calls for close cooperation between hydraulic and structural engineers.

I have recently completed a "fluid polariscope" in the Hydraulic Laboratory at the University of Colorado that consists essentially of two sheets of

quarter-inch plexiglass 20 in. high, 50 in. long, placed half an inch apart. A 1.5 percent suspension of California bentonite is pumped between these plates to give a varied rate of flow. Two-dimensional models of the sections to be studied are made from black plexiglass and placed between the large sheets of plexiglass.

The light from a battery of four photoflood bulbs passes through a 12-in. polaroid disk and then through a quarter-wave plate so arranged as to give circularly polarized light. As the circularly polarized light passes through the bentonite suspension (a streaming birefringent) it changes so that the amount of change is dependent upon the rate of shear in the fluid. These changes are visible when viewed through a second quarter-wave plate and polaroid. As shown in the accompanying photographs, flow patterns around two sections that will be of particular interest have been studied. These are I-sections, each with a length of 4 in. and depths of 0.65 in. and 1.56 in., giving a d/b of 0.163 and 0.39, respectively.

The velocity in each of the photographs, with the exception of *D*, is approximately the same. Photograph *A* shows the flow patterns around the first I-section with a $d/b = 0.163$ at a zero angle of attack. It should be noted that the flow pattern is almost symmetrical at both the top and bottom of the section. Although a very definite vortex trail can be seen with the naked eye, it is hard to see it in the photograph.

In order to deflect the fluid downward, there must be a downward force, and since the net force must be zero, there will be an upward force in the section. This force will be applied near the trailing edge tending to give the section a negative (and on the next oscillation a positive) angle of attack.

Photographs *B* and *C* show the flow patterns past a section with a d/b ratio of 0.39. The vortex trail seen in *A* is not as prominent for the larger ratios, but definite eddies are formed and may be seen in motion pictures. The pressure on the upstream half of the web of the I-section will be negative, as may be determined by the curvature of the flow lines. The pressures on the last half of the section are mainly negative, but sharp fluctuations may at times produce positive pressures.

The section with $d/b = 0.39$ was tested at a negative angle of attack of 3°, with results as shown in *D*, *E*, and *F* and with a positive angle of attack of 10° as shown in *G* and *H*. These pictures agree exactly with Fig. 1, in Dr. Steinman's article in the January issue, and give visual proof that the pressures plotted there do exist and, further, that the angle of attack seems only to reinforce the difference in pressure. The section is obviously torsionally unstable.

Throughout these pilot tests I have been unable to find any combination of angle of attack and velocity that would give a flow pattern which could yield the pressure distribution shown in Dr. Steinman's Fig. 2. It is my belief that the section studied ($d/b = 0.39$) is both torsionally and vertically unstable because the counter-clockwise moment exerted by the pressure acting on the section will cause the angle of attack to change, thus changing the net lift in the section. The increased size of the flange and the attack angle combine to shield the side of the I-section in the direction of increasing angles of attack and cause lower pressures in this section. This agrees with the general aerodynamic action of airfoils and should continue until a "stall" is reached.

When the net lift changes, the section will rise or fall some measurable distance, depending upon the rigidity of the supports. It is this change in lift caused by the change in angle of attack, which in turn is caused by the unsymmetrical pressure forces, that makes the section vertically unstable. As shown in the photographs, the stream pattern is symmetrical for a zero angle of attack, and when the angle is not zero the moment is directed so as to decrease the angle of attack. When rotating in a direction that will decrease the angle of attack, the relative velocities of the section and the fluid will give a net increase to the angle which in turn gives a greater moment forcing the section to go past the zero point and oscillate back and forth.

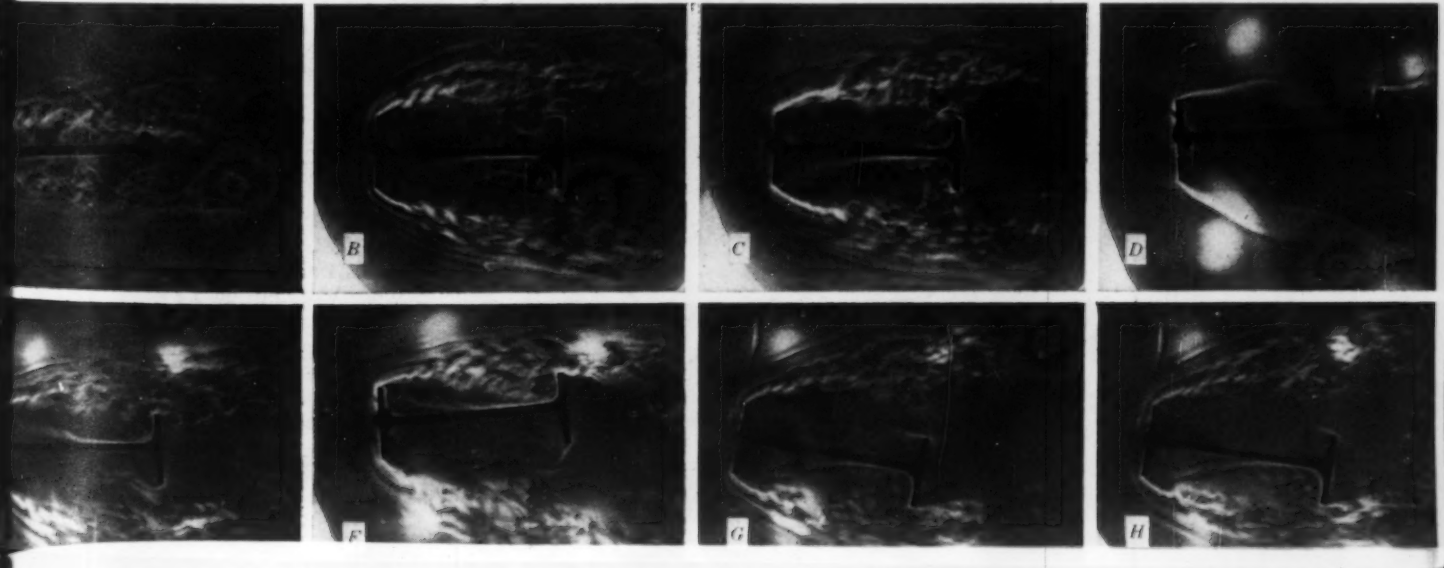
A given section may then be vertically stable if it can tilt so that the angle of attack becomes zero. For a free body in a flowing fluid (one with little restraint in the vertical direction) the body will be vertically unstable if it is torsionally unstable. The problem which immediately presents itself is to reduce the torsional forces involved to the point where the natural rigidity of the structure will be enough to prevent large vertical oscillations. This can be done best by a combination of experience and a laboratory investigation of the particular section.

If flow patterns for any particular two-dimensional models half an inch thick are desired, arrangements for obtaining them may be made by getting in touch with the writer.

JOHN H. DAWSON, Jun. ASCE

Boulder, Colo.

PHOTOGRAPHS SHOW RESULTS OF STUDIES made by fluid polariscope in Hydraulic Laboratory at University of Colorado. Photograph A shows flow patterns around I-section, with d/b = 0.163 at zero angle of attack. Vortex is hard to see, but neutral line is visible between first two vortices. Photographs B and C show flow patterns past section with d/b ratio of 0.39. Section with d/b = 0.39 was tested at negative angle of attack of 3°, with results as shown in D, E, and F, and with positive angle of attack of 10° as shown in G and H.



SOCIETY NEWS

EDITORIAL:

The Next Decade

ENGINEERS AND SCIENTISTS "in methods and objectives have a promising untried technique for the solution of public problems. . . . It may be time to give the engineer a chance."[1]

"Old slogans and old clichés must be supplanted with knowledge. . . . Yours is the responsibility, not only for showing us how to run our business, but also for making us think."[2]

Such expressions are appearing with increasing frequency. The profession has been known for a "becoming modesty," highly creditable in some respects, but probably not in the best interests of the public or even of its members. Today we are realizing that isolation of engineers and the engineering method, within the technical field, is no longer a practical possibility.

In the field of our own personal interests, our distressful experience under the administration of the Wagner Act has, possibly, been a blessing in disguise; it has shocked us into a knowledge that there is still work to be done before our professional status is recognized in all quarters.

The last five years, and the short postwar period in particular, have seen a resurgence of faith in professional conscientiousness and attitude, and a steadily growing conviction that our knowledge and ability must be more generally devoted to public interests.

Within the profession, there has been an increasing awareness of its essential unity, regardless of varying technical interests. The Engineers Joint Council in its short life has gone far in developing vision of such solidarity and in putting it in service. Within the ASCE, there is a newly obvious but only partly declared objective of bringing the whole untried strength of the membership into one well-organized working body.

This is indicated in the policy of our Boards of Direction, of spreading out to the Local Sections as much as possible of the national program, and by the quick response of our members to the possibility of individual participation in constructive and progressive action.

There seems to be a growing conviction that the profession should do a still better job in inducting the younger members into its work and that their strength and ingenuity should be given wider opportunity.

To those who have analyzed our financial position, it is clear we cannot maintain our technical interests and move forward in the field of professional development without additional financial support by the membership as a whole. The dues we have been paying—fixed many years ago—do not cover even our present accepted program.

There is need to know the attitude of our whole membership with respect to our present and future program. The two proposed amendments to the Constitution, when brought to a vote, will provide the answer to what we are to do in the immediate future, and what our standing will be at the end of the next decade.

[1] John Mills, *The Engineer in Society*.
[2] Paul G. Hoffman, before the American Institute of Consulting Engineers.

W. W. Horner
Past-President, ASCE

Essential Functions Are Performed by UET

UNITED ENGINEERING TRUSTEES (UET) was created by the four principal engineering societies, which were therefore called the Founder Societies, in 1904. At the turn of the century, Andrew Carnegie was approached to provide a library building for the Latimer Clark collection, which was the second most important electrical and scientific library in the world, and which, after the death of its owner, was bought by Schuyler Skaats Wheeler, who presented it to the American Institute of Electrical Engineers.

Mr. Carnegie became interested in the idea of the engineering societies cooperating, in fact, in uniting under the same roof. The result was the Engineering Societies Building, erected by money given by Mr. Carnegie, on land purchased by friends of the societies, and dedicated in 1907. The building is 16 stories high and covers a ground area of 115 ft front by 90 ft deep. Owing to some legal difficulties in having separate societies jointly own real property, the representatives of these societies introduced into the legislature of New York a bill to create United Engineering Trustees, Inc., a body corporate to administer the building and in other ways "advance the engineering arts and sciences."

UET's Board of Trustees is made up of 12 men, appointed by each society. Each trustee serves four years, and is eligible for reelection for not more than two additional terms.

Besides being titular owner of the Engineering Societies Building, UET administers trust funds for the Engineering Societies Library, the Engineering Foundation, the John Fritz Medal Board of Award, and the Daniel Guggenheim Medal Board of Award. It also acts as treasurer for Engineers' Council for Professional Development. It retains competent financial custodians and advisers, legal counsel and consulting architects. Its accounts are audited by certified public accountants. UET has two departments—the Engineering Societies Library and the Engineering Foundation.

Thus, United Engineering Trustees, Inc., is a creature of the Founder Societies, empowered by charter, enabled by experience, and directed by representatives appointed by the Founder Societies, to conduct the business of the Founder Societies in their joint interests.

Water Use Headlines Phoenix Meeting of ASCE

Board Recommends Nation-Wide Survey of Water Resources

A NATION-WIDE SURVEY of America's water resources was recommended by the Board of Direction at its meeting in Phoenix, April 22. The Board's action, recognizing the importance of water to the economy of the nation, proposed that the Engineers Joint Council appoint a committee to explore the many possibilities of such a survey enlisting cooperation of all federal and state agencies dealing with the problem. The Board's action reflects the attention given to the water problem at the many sessions of the Phoenix meeting.

Dinner and Dance at Westward Ho

Indicative of the careful planning by the local arrangements committee was the enthusiasm shown by the 680 members and their wives who attended the various functions during the three-day period, April 23-25. A buffet dinner and dance at the Hotel Westward Ho will be remembered by those attending for the interesting local color introduced by the entertainment committee.

Attention was focused on a series of radio broadcasts—one one-half-hour program and three 15-minute programs—over stations KTAR, KPHO and KOY in Phoenix. Officers and Directors of the Society, as well as some of the authors of papers presented before Technical Divisions participated in this series of symposiums, in which they discussed the ASCE, its functions and the functions of civil engineers in war and peace. The theme of the meeting, development of the Colorado River, was evident in the series of broadcasts.

Board Members Speak

Addresses on the functions of ASCE and the work and interests of the engineering profession in general were delivered by Board members before civic organizations in Phoenix during the week of the Spring Meeting. The speakers and organizations were:

President Hastings addressed the Phoenix Chamber of Commerce at a breakfast meeting.

Past-President Horner addressed "The Dons" club, a group of business and professional men, at a luncheon.

Vice-President Shannon addressed the Phoenix Advertising Club at a luncheon.

Director Koch addressed the Kiwanis Club at a luncheon.

Director Roy W. Crum addressed the Phoenix Exchange Club at a luncheon.

Director Harry F. Thomson addressed the Phoenix Lions Club in the Westward Ho Hotel.

Packing many surprises, and a hit with all who participated, was the Western Party Dinner held at the Valley of the Sun Studio. A setting out of the Old West was brought to life by a troop of "cowboy" movie actors and actresses, who were present in costume. The success of this party was the result of extensive spade work by an imaginative and enthusiastic entertainment committee. The party will long be remembered by those who were lucky enough to be present.

Ladies Enjoy Many Features

A tour through Papago Park Botanical Gardens and the Phoenix Date Farm started the ladies on a full day of entertainment—Thursday. A special luncheon at the Jokake Inn, winter resort in Arcadia, was followed by a visit to "Taliesin West" in Paradise Valley, winter headquarters of Frank Lloyd Wright's architectural fellowship.

Inspection of the largest copper mines in Arizona, at Miami and Inspiration, afforded a group of 75 registrants the opportunity to see the natural beauties of Arizona as well as to learn the intricacies of open-pit workings and the finer points of refining copper ores.

Members who attended the technical sessions and other functions during the first two days of the meeting were attracted to many points of engineering and historical interest in Arizona on Friday and Saturday of the meeting week. Most popular of the unscheduled points of interest were: Mesa Mormon Temple; South Mountain Park near Phoenix; Boulder, Roosevelt and Bartlett dams; and the Grand Canyon.

ASCE Members Cited for Outstanding Work

IN CEREMONIES HELD April 14 at Governors Island, New York, President's Certificate of Merit is presented to (left to right) Malcolm Pirnie, Past-President ASCE, chairman of Executive Committee of Engineers Joint Council, New York consulting engineer; Carlton S. Proctor, Past Director ASCE, New York consulting engineer; and Harry S. Rogers, M. ASCE, president of Brooklyn Polytechnic Institute, for outstanding wartime and postwar services in industrial control of Germany and Japan. Robert E. McConnell, Medley G. B. Whelpley and Sidney Dale Kilpatrick received similar awards at these ceremonies. See articles in CIVIL ENGINEERING: "Industrial Disarmament of Aggressor States (Germany)," November 1945, page 524; "Program for Industrial Disarmament of Japan Proposed by EJC," July 1946, page 292; "Engineers' War Detection Plan Receives National Recognition," December 1946, page 536.

All Four ASCE Zones Sign Petitions

Ask Amendments Raising Dues, Enfranchising Juniors

PETITIONS BEARING more than the required 75 Corporate Member signatures from each of the four ASCE zones have been received at Society Headquarters, requesting Constitutional amendments to: (1) Give Juniors the vote; and (2) increase Society dues $5 per year for Corporate Members and Affiliates and $2.50 annually for Juniors.

As a result, amendments to the Constitution pertinent to these questions will be considered at the Summer Convention of the Society in Duluth, Minn., July 16, and will be sent to ballot shortly thereafter. To date, petitions resulting from organized circulation at Local Section meetings have been received as follows:

	To Enfranchise Juniors	To Increase Dues
Zone I	234	204
Zone II	435	354
Zone III	463	390
Zone IV	336	285
Totals	1,468	1,233

The petitions received are from 42 Local Sections and represent 64 percent of the Society's 66 Local Sections. Other Local Sections still are considering the petitions and the issues.

In many instances, the petitions were signed by members attending Local Section meetings held before full discussion of the financial facts subsequently presented in talks by officers, Directors, and staff members, and in CIVIL ENGINEERING. This, perhaps, accounts for the fact that there were 235, or 16 percent, fewer signatures on the petitions for increasing dues than on those for enfranchising Juniors.

Since the ASCE Board of Direction recommended the increase in dues, in order to sustain the Society's professional, as well as technical activities, there has been a lively interest in this matter in engineering circles. Indicative of that interest is an editorial published by *Engineering News-Record* in its issue of April 3. Under the heading, "Something for Nothing," this McGraw-Hill publication said:

"An issue of interest to all professional societies is raised by the cool reception accorded to the current plan to raise the dues of members of the American Society of Civil Engineers. Judged by the reaction to petitions asking the Board of Direction to put the matter of higher dues before the members in the form of an amendment to the society's constitution, the prospects for the proposed increase do not appear bright.

"The reason for this is not obvious in the ASCE record. No one could have attended meetings of that society in recent years without gaining a clear impression that, in addition to the society's activities in technical matters, the membership at large wanted it to take leadership in obtaining wider understanding of the part that engineers play in the daily life of every citizen and in fostering greater dependence on engineers for advice on national and international issues. And it appears true also that a large majority of the membership wanted the society to work for better pay for the rank and file of engineers and that a considerably smaller number favored having the society work for establishment of the principle that engineering employees should not be compelled to join collective-bargaining groups in which they have little voice.

"There can be no doubt that it was to attain these objectives that successive boards of direction of the ASCE have expanded the society's activities beyond purely scientific fields. Outstanding among these newer activities are the maintenance of a full-time representative in Washington to keep members of Congress and heads of federal departments advised as to the society's position on matters affecting engineers; and establishment of regional offices to facilitate prompt action by the society, especially on economic questions of interest to engineers.

The society has also moved beyond its former field of activity in providing aid to engineering employees in the establishment of independent collective-bargaining groups, and in making studies of pay and employment conditions among engineers in state highway departments and similar public agencies to aid in improving conditions for those engineers. Expansion of the society's facilities for publicizing the work done by the society and its members has been undertaken; and, finally, the society has taken an active part in the Engineers Joint Council and in the international organizations of engineers that are just beginning to take form.

"These activities cost money. They could not have been carried on along with the society's technical work had it not been for the fact that the society's membership has been steadily increasing. Now the time has come when that increase no longer offsets the added costs. As a result, the board has asked the members to authorize an increase in dues. If the board erred, it erred on the side of conservatism because there is good reason to expect still further increases in costs of the national and international activities that engineers appear to want.

"Thus, the issue now before members of the ASCE is larger than just a $5 increase in dues. And its significance extends far beyond the ASCE, for a similar situation exists in the national and state societies of professional engineers where a few men are attempting to carry on very worthwhile work with financial support from only a handful of the thousands of registered professional engineers.

"By their vote on this question of an increase in dues the members of the ASCE will be putting a large segment of the engineering profession on record as to whether it is willing to back with dollars its desire for wider public recognization or whether it seeks something for nothing."

State of Washington Adopts New License Law

A NEW ENGINEERS' REGISTRATION ACT, patterned after the 1946 edition of the Model Registration Law, which the ASCE helped draft and promulgate, has been passed by the Washington State Legislature and signed by the governor. It will become a law at the expiration of a period of 90 days after the date of the governor's signature.

As noted in the April issue of CIVIL ENGINEERING, the bill was introduced in the current session of the Washington State Legislature by ASCE Vice-President William D. Shannon. Mr. Shannon was elected to represent the forty-third district in the legislature in the 1946 elections.

Copies of the new law may be obtained, as soon as they are received from the printer, from the Secretary of the Washington State Board of Engineering Examiners, Transportation Building, Olympia, Wash.

Changes in Amendments to National Labor Relations Act Affect Professional Employees

E. L. CHANDLER, M. ASCE
Eastern Representative, ASCE, Washington, D.C.

THE LABOR COMMITTEES of both the Senate and House of Representatives concluded hearings relative to amending the National Labor Relations Act during March and each committee has been working on its draft of a bill.

On April 7, Senator Taft, chairman of the Senate Committee, released a "Committee Print" of a tentative bill prepared by a subcommittee. While this has not been approved by the full committee and is subject to modification, it is of interest to note provisions relating to professional employees.

Sec. 2 (14) contains the following definition of professional employee: "(*a*) any employee engaged in work (i) predominantly intellectual and varied in character as opposed to routine mental, manual, mechanical, or physical work; (ii) involving the consistent exercise of discretion and judgment in its performance; (iii) of such a character that the output produced or the result accomplished cannot be standardized in relation to a given period of time; (iv) requiring knowledge of an advanced type in a field of science or learning customarily acquired by a prolonged course of specialized intellectual instruction and study in an institution of higher learning or a hospital, as distinguished from a general academic education or from an apprenticeship or from training in the performance of routine mental, manual, or physical processes; or

"(*b*) any employee, who (i) has completed the courses of specialized intellectual instruction and study described in clause (iv) of paragraph (*a*), and (ii) is performing related work under the supervision of a professional person to qualify himself to become a professional employee as defined in paragraph (*a*)." The wording of this definition is identical with that contained in bill S. 360, except in two respects. The clause (iv) relating to educational requirements has been expanded to include specialized instruction and study in "a hospital," as well as "in an institution of higher learning," and no reference is made to registration or licensing.

The bill would outlaw closed-shop agreements between an employer and his employees but would permit an agreement for maintenance of a union shop.

In Sec. 9 (*b*), it is stated that the National Labor Relations Board "shall not decide that any unit is appropriate . . . if such unit includes . . . both professional employees and employees who are not professional employees unless a majority of such professional employees vote for inclusion in such unit."

The original bill proposed flat prohibition of the inclusion of professional employees and non-professional employees in the same bargaining unit. It will be noted that the current wording would permit formation of a heterogeneous unit if a majority of the professional employees to be affected were to vote for inclusion in such a unit.

As of this writing the House Committee has made public nothing as to the kind of bill it will produce. It is understood that there is much divergence of opinion among the members of that committee on many phases of pending legislation. At one time it was believed that the House bill would contain provisions substantially in accord with those above mentioned. Later reports have indicated that there may be no special reference to professional employees in the House draft.

While the Senate provisions are not exactly in accord with the legislation advocated by the panel of engineers which appeared before the Congressional committees (CIVIL ENGINEERING for April 1947, page 44), it is obvious that if these provisions become law, professional employees will find themselves in a far more favorable situation than has been the case under the present Wagner Act.

Professional employees in any organization could vote to refrain from collective bargaining if they wished to do so, and would be guaranteed the right to a bargaining unit composed, exclusively, of professional employees if such a course were desired.

"What Do I Get for my ASCE Dues?" Brings Answer from Section Editor

THAT OLD QUESTION of whether it is more blessed to give than to receive seems to have been revived in many quarters since last October when the ASCE Board of Direction recommended an increase in Society dues. Latest instance in which the question, "What Do I Get for My ASCE Dues?" has been raised is cited in the March issue of *The Range-Finder*, publication of the Indiana Section, ASCE.

At a recent meeting, a Junior asked the question, and Editor E. C. Thoma, also a Junior, took it upon himself to answer. After observing editorial courtesy, by offering the inquirer, who raised the question orally at a Section meeting, opportunity to answer in a future edition of the publication, Editor Thoma says, in part:

"I joined the ASCE because since the tender age of 7 or 8 I've had a very burning desire to be a good civil engineer. The ASCE offered me an opportunity upon graduation of keeping abreast of all phases of civil engineering, progress—new ideas—new hopes. It afforded me an opportunity to meet proven civil engineers occasionally at meetings of Local Sections. It gave me an opportunity to join a society of high repute in a profession I selected to follow for the next 50 years, God and my employers being willing.

"I had nothing to offer the ASCE except my unproven self. By associating myself with them I was gaining the wisdom and prestige of the 86-year-old Society [he joined in 1938] to which civil engineers who qualified themselves belonged. Ambition and willingness were all I had to offer them, but I was accepted graciously.

"Since the change of policy in 1940 to include the social aspects as well as the technical learnings of engineers, the ASCE opened the door to us Juniors to engage in more of the Society's activities. We as Juniors then must assume these opportunities by our own assertion. It means they—the proven engineers—have increased our opportunity to establish ourselves and our profession in a world of changing conditions.

"We as Juniors thus will get out of this Society something more than what perhaps each of us will put into it—mainly a high PROFESSIONAL level . . . . We as Juniors must carry our load if we want privileges. It isn't 'What will you give me?' but rather 'I'm willing; what may I do?'"

Montana Civil Engineers Successfully Sponsor State Registration Bill

MONTANA CIVIL ENGINEERS, a group composed of nearly 100 of the state's practicing engineers and land surveyors, successfully sponsored a bill requiring the registration of civil engineers and land surveyors in Montana, the 48th state to adopt such legislation. The signing of the measure, Senate Bill 66, on March 1 by Governor Sam C. Ford was witnessed by representatives of the group in the executive offices at the state capitol.

Those present on this historic occasion, including several members of ASCE, are shown in the accompanying photograph. John W. Hall, consulting engineer of Fort Shaw and chairman of Montana Civil Engineers, was not present.

Signing of this bill marks the end of nearly 30 years of sporadic effort by the engineers of Montana to obtain such legislation. It completes the roster of states, all of which now are in support of the lengthy campaign by the nation's engineers to raise their professional standards by setting up qualifications and requiring the registration of practicing engineers. The first registration act of this kind was passed in Wyoming 40 years ago.

The bill adopted in Montana exactly coincides with the Model Law sponsored by national engineering groups except for necessary modifications to make it applicable to civil engineers and land surveyors only. The sections that differ from the Model Law are the following:

"Section 3. Definitions. . . .

"(1) Civil Engineer: The term 'Civil Engineer' within the meaning and intent of this Act shall mean a person who, by reason of his special knowledge of the mathematical and physical sciences and the principles and methods of engineering analysis and design, acquired by professional education and practical experience, is qualified to practice civil engineering as hereinafter defined, as attested by his legal registration as a civil engineer."

"(3) Practice of Civil Engineering: The term 'Practice of Civil Engineering' within the meaning and intent of this Act shall mean any professional service or creative work requiring engineering education, training, and experience and the application of special knowledge of the mathematical, physical and engineering sciences to such professional services or creative work as consultation, investigation, evaluation, planning, design, and supervision, of construction for the purpose of assuring compliance with specifications and design, in connection with any of the following: river, irrigation, hydraulic, water supply, sewers and sewage disposal projects, railroad design and construction, and structures; highway design and construction projects; structural design and construction projects. . . ."

Senate Bill No. 66 was introduced jointly by Senator Manning of Treasure County and Senator McQuitty of Wheatland County. Both have wide knowledge of engineering work through past experience as engineers and contractors.

After passing the Senate, the bill was supported in the House by Representative Roy Malsor, engineer and contractor, Gallatin County, and Representative Mike Loughran of Silver Bow, who at one time held the post of Surveyor in that county. Governor Ford will appoint a five-man board of engineers to administer the act, to become effective July 1, 1947.

MEMBERS OF MONTANA SECTION witnessing signing of registration bill by Montana's Governor Sam C. Ford are (left to right): John H. Morrison, M. ASCE, consulting engineer of Helena and Director, Montana Civil Engineers; William J. Wenzel, chief engineer, Corwin & Co., Great Falls, and vice-chairman, Montana Civil Engineers; E. H. Thomas, Assoc. M. ASCE, Bridge Plans Engineer, Montana Highway Commission, secretary, Montana Civil Engineers, and secretary, Montana Section of ASCE; C. S. Heidel, M. ASCE, Hydraulic Engineer, U.S. Geological Survey, Helena, and past-president, Montana Section of ASCE; John G. Link, engineer and architect of Butte, and director, Montana Civil Engineers; E. A. Dalakow, Assoc. M. ASCE, Montana Engineering & Construction Co., Helena.

Questionnaire on Fees Is Mailed to 250 Firms

ON APRIL 21, the Society's Committee on Private Engineering Practice mailed a questionnaire to 250 firms engaged in consulting practice in the field of civil engineering, requesting constructive criticisms, comments, and suggestions on the fee schedule that was recommended by the Society in 1935 (CIVIL ENGINEERING, May 1935, page 316, and reprinted as ASCE publications 1935-2, 1937-1, and 1938-1). The questions relate solely to percentage rates and their applicability to types of projects, including items to be included or excluded under these rates.

The Committee worked during the past two years on a general revision of Manual No. 5, "Charges and Methods of Making Charges for Professional Services," published in 1930, and on its companion Manual No. 6 which is an epitome of No. 5 for the use of clients. Many consultants, however, have expressed an increasingly urgent desire for up-to-date recommendations on percentage rates, in response to which the Committee is now seeking the necessary basic information with a view to producing an interim report, limited to this subject, as quickly as possible.

The original mailing list is not intended to be exclusive. Any consulting engineer practicing in the field of civil engineering is urged to furnish information. A copy of the questionnaire will be sent upon request to the Executive Secretary, ASCE, 33 West 39th Street, New York 18, N.Y.

EJC Fosters Engineers' Interest in Current Science Legislation

LEGISLATION PROVIDING for the establishment of a National Science Foundation is again pending in both Houses of Congress. It will be recalled that the last Congress failed to pass S. 1850. (See CIVIL ENGINEERING for April 1946, page 182, and September 1946, page 406). Under the title of "Science and Engineering," a plea for the establishment of such a foundation was made by Boris A. Bakhmeteff, Hon. M. ASCE, chairman of the EJC Panel for promoting the interests of engineers in a National Research Foundation, in the March 1946 issue of CIVIL ENGINEERING, page 99.

IN THE FALL OF 1945, upon discovery that engineering had been completely omitted from the text of Bills then being introduced for scientific research, ASCE instigated an EJC panel of informed engineers representing the five nationally known societies of professional engineers to present testimony before a Senate subcommittee. This testimony was published as a Senate document, "Hearings on Science Legislation (S. 1297 and related bills) 79th Congress, First Session, per S. Res. 107 and S. Res. 146."

Engineering Omitted from Later Bills

It was only after consideration had been given to the testimony of the EJC panel that "engineering" was written into the so-called compromise Bill, S. 1850, which was passed by the Senate just prior to the adjournment of the 79th Congress. In the earlier drafts of this legislation, largely stimulated by groups of "pure scientists," the omission of engineering in the legislation is understandable. Now, it is not. ASCE and other Founder Societies have grounds for misgivings that similar influences again appear to be minimizing the importance of engineering in present National Science Foundation legislation. This fact is reflected in the new Bills S. 526 and H.R. 1815, 1830 and 1834.

Even in the present S. 525 and its counterpart H.R. 942, which are virtually a repetition of the old compromise Bill S. 1850 (79th Congress) there are unfortunate omissions of engineering. For example, in S. 525, Section 6, where there appears the list of sciences for which scholarships are to be awarded, the word "engineering" is not inserted between the words "physical" and "biological" as it appears in Section 3-*b* and 12-*a*. This is but a straw indicating the direction of the wind.

Other indications of these influences are seen in the recent testimony before the House Commerce Committee, where questions were raised as to whether engineering even belongs in legislation dedicated to basic scientific research. Another manifestation is that neither EJC nor its Science Legislation Panel were given prior notice of the House Commerce Committee hearings so as to permit the engineering profession to be duly represented at the hearings. This "oversight" occurred in spite of the fact that it was well known to the group which programmed these hearings that EJC had presented substantial testimony on this legislation when it was in the 79th Congress and that the 80,000 engineers represented by EJC are deeply interested in the matter.

Credit is due Dean Thorndike Saville, Director ASCE, for giving EJC the opportunity to get its statement into the present record. It was Dean Saville who, while attending the hearing to give testimony as representative of the "Engineering Colleges Council," learned of the omission of an invitation to engineering groups to report.

EJC Panel Chairman Makes Statement

Engineers Joint Council, through its Panel chairman, Dr. Boris A. Bakhmeteff, Hon. M. ASCE, has since presented a statement to the chairman of the House Commerce Committee in an attempt to fill the engineering testimony void. Dr. Bakhmeteff's statement complements the engineering testimony presented last year, and attempts to clarify the meaning of the terms "applied" as against "pure" science as they relate to this proposed legislation.

The statement emphasizes that engineers consider it particularly important to the public interest that provision be unmistakably established in a National Science Foundation for the development of basic engineering research and for the training of scientifically apprenticed engineers.

Vigorous Unanimity of Engineers

Engineers will no doubt favor one bill or another among all those now understood to be under consideration by the House Commerce Committee. Although there may not be unanimity of opinion as to the details of these several pieces of science legislation, there is vigorous unanimity among engineers that engineering should not be relegated to the background or omitted from this legislation. Engineers are in complete agreement that the sooner national science legislation, including engineering, can be made law, the better the immediate as well as the long-term interests of our country will be served.

ASCE to Be Represented at President's Fire Prevention Conference

THE FIRE PREVENTION CONFERENCE called by President Truman in Washington, D.C., on May 6–8, 1947, represents the first organized national effort to combat the fire menace that delays national economic recovery after every war. President E. M. Hastings has named James E. Jagger, Assistant Secretary of the Society, as its official representative to this conference. State and municipal authorities will join with fire-protection experts, scientists and others in studying ways to reduce the death toll and keep property damage at a minimum. Fire experts say that, if losses follow the same trend as they did after World War I, property destruction will reach a billion dollars a year by 1953.

Major General Philip B. Fleming, Federal Works Administrator and Administrator of the Office of Temporary Controls, who has been appointed general chairman of the conference, is directing the assembly of data to be acted upon at this meeting. Helping him in this work are the following six committees: Building Construction, Fire-Prevention Education, Fire-Fighting Services, Laws and Law Enforcement, Organized Public Support, and Research.

Losses for the first two months of 1947 exceed last year's losses for the same period by more than 20 percent. This year's losses total $121,939,000, and those for the 12 months ended February 28, 1947 were $581,347,000, the greatest this country has ever known. This figure exceeds by nearly $20,000,000 the previous high of $561,980,000. In 1947 no fire disaster has taken the large toll of lives exacted by the Winecoff and La Salle hotel fires in 1946, yet the death toll is mounting because of the thousands of smaller fires throughout the country.

What Is Professional Recognition?

N. W. DOUGHERTY

Dean of Engineering, The University of Tennessee, Knoxville

PROFESSIONAL RECOGNITION may mean many things from certification by an official, or a self-appointed body, to general acclaim by the public at large. To be real and lasting it must be deserved because of professional achievement, and such achievement must be acceptable to both the profession and the general public. Only trained professionals can distinguish between good and excellent achievement and consequently formal recognition must be by the profession itself. Fortunately the public will take professionals at their own estimate of themselves, consequently public acclaim becomes a reflection of the professional attitude of individuals toward themselves and their work.

Because of their background of design and construction, engineers are apt to think of recognition as something that they can design and build rather than as something that grows over a long period of time. They can, by taking thought, improve the climate or the conditions of growth but they cannot force recognition by merely increasing the shifts and shouting a little louder. Its growth is more like the tree of the forest than the quick responding plant of the greenhouse. Underbrush may be cleared and the branches may be trimmed, but the growth must be the result of good atmosphere, good climate, and favorable conditions.

What do we mean when we talk about professional growth? There are certain qualitities or characteristics which are peculiar to members of a profession, and the process of acquiring these qualities may be considered as professional growth for individuals. Obviously they must be first acquired by individuals before they can become characteristics of a group.

Engineers individually can start recognition by personally adopting a plan of activity which will develop their own aptitudes and will show forth to the public that they are professional.

All engineers should subscribe to the "Faith of the Engineer" [see accompanying illustration], not only as members of a professional group but as individuals who practice the faith in everyday life and then they will contribute their share to the general recognition of professional status. In addition they must define professional status and keep it before themselves as they go about their daily tasks. Each individual must make his own definition but the general terms should be acceptable to professionals everywhere. Last year the Committee on Professional Recognition of ECPD made a composite of many statements showing the attributes of a profession and its practitioners.

Attributes of a Profession and Its Practitioners

Of a Profession:

1. It must satisfy an indispensable and beneficial social need.
2. Its work must require the exercise of discretion and judgment and not be subject to standardization.
3. It is a type of activity conducted upon a high intellectual plane.
   a) Its knowledge and skills are not common possessions of the general public; they are the results of tested research and experience and are acquired through a special discipline of education and practice.
   b) Engineering requires a body of distinctive knowledge (science) and art (skill).
4. It must have group consciousness for the promotion of technical knowledge and professional ideals, and for rendering social services.
5. It should have legal status and must require well-formulated standards of admission.

Professional Practitioners:

1. They must have a service motive, sharing their advances in knowledge, guarding their professional integrity and ideals, and tendering gratuitous public service in addition to that engaged by clients.
2. They must recognize their obligations to society and to other practitioners by living up to established and accepted codes of conduct.
3. They must assume relations of confidence and accept individual responsibility.
4. They should be members of professional groups and they should carry their part of the responsibility of advancing professional knowledge, ideals, and practice.

The faith of the engineer is a matter for the individual; his place in a profession depends upon his own actions and those of his fellow professionals. As groups there are a number of things which may be done that will enhance our own esteem and will greatly improve the public estimate of engineers as a group.

A number of things seem obvious and yet we must remind ourselves of them or we will allow them to slide into neglect. Probably the first is *professional unity*. The profession has just passed through a period of unusual cooperation. We had to strive for the same goal to achieve victory and as we worked for victory we realized the need for greater unity of action. There was no agency in the United States which could speak for the engineers as a group.

Engineering nomenclature suggests individuality. For example, the member-

FAITH OF THE ENGINEER

ECPD

I AM AN ENGINEER. In my profession I take deep pride, but without vainglory; to it I owe solemn obligations that I am eager to fulfill.

As an Engineer, I will participate in none but honest enterprise. To him that has engaged my services, as employer or client, I will give the utmost of performance and fidelity.

When needed, my skill and knowledge shall be given without reservation for the public good. From special capacity springs the obligation to use it well in the service of humanity; and I accept the challenge that this implies.

Jealous of the high repute of my calling, I will strive to protect the interests and the good name of any engineer that I know to be deserving; but I will not shrink, should duty dictate, from disclosing the truth regarding anyone that, by unscrupulous act, has shown himself unworthy of the profession.

Since the Age of Stone, human progress has been conditioned by the genius of my professional forbears. By them have been rendered usable to mankind Nature's vast resources of material and energy. By them have been vitalized and turned to practical account the principles of science and the revelations of technology. Except for this heritage of accumulated experience, my efforts would be feeble. I dedicate myself to the dissemination of engineering knowledge, and, especially, to the instruction of younger members of my profession in all its arts and traditions.

To my fellows I pledge, in the same full measure I ask of them, integrity and fair dealing, tolerance and respect, and devotion to the standards and the dignity of our profession; with the consciousness, always, that our special expertness carries with it the obligation to serve humanity with complete sincerity.

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"FAITH OF THE ENGINEER" is guide not only to members of professional groups but to individuals who, if Faith is practiced in everyday life, will contribute their share to general recognition of professional status. Copies of "Faith of the Engineer" suitable for framing, in sizes of 15½ × 22 and 8½ × 11 (at $3.00 and $0.50 per copy, respectively), are available by writing to Engineers' Council for Professional Development, 29 West 39th Street, New York 18, N.Y.

ship grades of the several national societies are different and often the same grade does not require the same qualifications. For nearly 15 years the societies have recognized the desirability of uniformity, with all the societies willing to get it by having others adopt their nomenclature.

Each year brings additional fragmentation. The Civils break up into Water Works Associations, Highway Engineers, Railway Engineers; the Electricals break into Radio, Illumination, Communication; the Mechanicals break into Refrigeration, Aeronautical, Automotive; and the Chemicals break into Ceramic, Petroleum, and Plastic engineers. All these have national organizations and the end is not yet.

If engineers perform their obligations to society they should expect society to recognize them as they are. To get public respect and public esteem, the engineer must not only do his job well but he must see to it that the general public understands the difference between a technician and a professional practitioner. Too often the title has been loosely applied to various skilled trades, thus confusing the concept in the public mind. The engineman, or engine operator, has been popularly called an engineer for many years; others of the skilled trades have assumed the title.

To get the public respect that engineering deserves, engineers must tell about their more complicated works in a language that the public can understand. Behind the technician there is a man who is doing mental work rather then exercising manual skill. His task should be shorn of its mystery and brought out into the open for general understanding. Popular writings on science and technology can be made to serve a very useful purpose in this age of power and machinery.

At the first annual meeting of ECPD a "minimum definition" of an engineer was written:

> Graduation from an approved course in engineering of four or more years in an approved school or college; and a specific record of an additional four years or more of satisfactory practice.

Then was added the possible equivalent of a combination of study and practice which would simulate the above. It was hoped that this would be the requirement for membership in a society, for civil service recognition of professional grade and for beginning practice as certified by engineering registration. Probably the most universal form of certification today is state licensing or registration. Some 92,000 engineers have been certified in this way.

At least one more step must be taken, and its urgency is becoming apparent as the years slip by. Under the Wagner Act all employees not earmarked as an arm of management may form collective bargaining units. Because of the intense activity of the trade unions, the impact of a collective economy will be felt by engineering professionsals of all grades. Certainly we must define professional and confidential and we must be able to distinquish beginning professionals from the accepted non-professionals. Some work has already been done, but we are still in the early stages of a solution to this vexing problem.

If the engineer must give us his individuality in his search for economic security he must conform to group classifications. Already job analysis and job classification are spreading over into the professional fields, and this carried to its final conclusion will mean something comparable to jurisdictional activities in the trades.

The movement to get unity and professional recognition is more than forty years old. Much has been accomplished but so much remains to be done that we are in danger of being appalled at the magnitude of the task. To get the answer we must think upon these things and search for methods which will give us desirable solutions. The sign posts have been set, the direction of movement is becoming apparent, our task will be to get into the movement personally and as groups.

Presented at the Annual Meeting of the Tennessee Valley Section.

Alcan Highway Today Described at Meeting

IT IS NOW possible to satisfy wartime dreams of a trip along the Alcan Highway, according to Lowell R. Lauden, head of the geology department at the University of Kansas. In a talk on "The Alcan Highway Today"—given before the March 21 dinner meeting of The Kansas Section—Professor Lauden described a trip that he and his students made last summer on the emergency wartime highway, built by the Public Roads Administration in cooperation with the Army Corps of Engineers. The highway is 1,760 miles long, extending from Dawson Creek (about 600 miles northwest of Edmonton) to Fairbanks, Alaska.

To travel the Alcan Highway, the speaker stated, the tourist must first obtain permission from the Bureau of Traffic Control at Edmonton, Alberta. Driving conditions are good. There are no excessive curves or hills, the gravel-covered roadway is sufficiently wide, and the bridges are adequate for safe automobile travel.

Gasoline is about 65 cents per imperial gallon, and the greatest distance between gasoline stations is 150 miles. According to Professor Lauden, opportunities for fishing and photography are almost unparalleled.

ASCE Members Elected to Building Code Committee

ASCE'S CONTRIBUTION to the work of the American Standards Association has received recognition in that three ASCE members have been elected to the executive committee of the Building Code Correlating Committee of the Association. The election took place at the meeting of the committee in New York on March 14.

Committee membership is as follows: George N. Thompson, chairman, National Bureau of Standards; Theodore I. Coe, vice-chairman, American Institute of Architects; Clarence A. Willson, M. ASCE, American Society of Civil Engineers; A. V. Bekay, Associated General Contractors of America; Oscar T. Nelson, International Association of Governmental Labor Officials; C. T. Bissell, M. ASCE, National Board of Fire Underwriters; and Edward W. Roemer, M. ASCE, member-at-large.

State Highway Department Backs Alabama Section

INDICATIVE OF the progressive policies of the State Highway Department of Alabama is the encouragement given its highway engineers to exchange technical and professional views with other engineers of that state. This policy was evidenced most recently by a letter circulated by H. L. Nelson, Assoc. M. ASCE, assistant highway director, to all chief engineers and division engineers authorizing their travel to the Section's Spring Meeting in Birmingham.

The communication stated that "the type of program to be presented will be professionally and technically instructive and in general an enhancement to the ability of the engineers attending." The notice stated further that: "In keeping with long established custom in this respect, you are authorized to attend this meeting in line of duty and in travel status. You may also, as you see fit, allow the engineers of all grades who are members of the Alabama Section, as well as other engineers of your organization, down through the grade of associate engineer, the same privilege."

NEWS OF LOCAL SECTIONS

Coming Events

Central Ohio—Dinner meeting at the Chittenden Hotel, Columbus, May 20, at 6:15 p.m. The speaker will be William N. Carey, Executive Secretary of the ASCE.

Colorado—Dinner meeting at the Oxford Hotel, Denver, May 12, at 6:30 p.m.

Florida—Meeting at the Seminole Hotel, Jacksonville, May 8, at 7 p.m.

Ithaca—Joint meeting with the Cornell University Student Chapter in Ithaca on May 15.

Maryland—Annual entertainment meeting at the Engineers Club, Baltimore, May 21, at 6 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, May 21, at 8 p.m.

Northwestern—Dinner meeting at the Campus Club, University of Minnesota, May 5, at 6:30 p.m. Prizes will be awarded to engineering students, and Hibbert Hill will speak on "Increasing the Security and Capacity of the Panama Canal."

Oklahoma—Dinner meeting at the Tulsa Hotel Coffee Shop, Tulsa, May 2, at 7:30 p.m.

Philadelphia—Dinner meeting at the Engineers Club, Philadelphia, May 13, at 6 p.m. Program starts at 7:30 p.m. All arrangements made by the Juniors of the Section.

Providence—Joint meeting with the Connecticut and Northeastern Sections on May 24. Inspection trip to U.S. Naval Air Base at Quonset, R.I., at 2 p.m.; dinner meeting at Crown Hotel, Providence, at 6:30 p.m.

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday at 12 noon.

Tennessee Valley—Dinner and smoker of the Chattanooga Sub-Section at the Hotel Patten, Chatta-nooga, May 13, at 5:15 p.m.

Texas—Spring meeting at the Rice Hotel, Houston, Tex., May 15–17. Luncheon meeting of the Dallas Branch at the Adolphus Hotel, May 5, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel, Fort Worth, May 12, at 12:15 p.m.

Virginia—Annual two-day joint spring meeting with the local sections of the other Founder Societies. At the Nansemond Hotel, Norfolk, Va., May 16 and 17, with the Engineers Club of Hampton Roads acting as host. All engineers in the area are invited to attend.

Wisconsin—Meeting in the Milwaukee Public Service Bldg. Auditorium, Milwaukee, May 21, at 8 p.m.

Scheduled ASCE Meetings

SUMMER CONVENTION,
Duluth, Minn., July 16–19
(Board of Direction meets
July 14–15)
FALL MEETING
Jacksonville, Fla., October 15–17
(Board of Direction meets
October 13–14)
ANNUAL MEETING
New York, N.Y., January 21–23
(Board of Direction meets
January 19–20)

Recent Activities

BUFFALO

CONCERN FOR Buffalo's critical transportation problem has prompted the Section to schedule two meetings on the subject. At the April meeting, Henry Osborne, traffic adviser to the city, discussed the transit and traffic problems of the city from the standpoint of municipal authorities. The viewpoint of the operating utility company will be presented at a later meeting. Maintenance of dams, powerhouses, and other hydraulic structures in regions where winter conditions are severe was covered by Joseph Lamprecht, consulting engineer of Syracuse, N.Y., at the March meeting.

CENTRAL OHIO

THE WORK OF the antennae laboratory at Ohio State University was described by Robert A. Fouty, research associate in the electrical engineering department of the University, at the March 27 meeting. This laboratory was the only one of its kind in existence at the beginning of the war, and the armed services relied on it for performance data on aircraft antennae. Through the use of model techniques, Mr. Fouty said, the laboratory is able to determine the pattern of effectiveness of an antenna on a particular airplane in one day. To achieve the same results with a full-sized model requires approximately a year. Colored slides and moving pictures of the testing techniques supplemented Mr. Fouty's talk.

CINCINNATI

SPEAKING ON "Atomic Power in Industry" at the April 2 meeting, Hoke Greene, dean of the graduate school of engineering at the University of Cincinnati, stressed the applications of the radioactive by-products of atomic processes. Dr. Greene also emphasized the relationship between industrial and military uses of atomic energy. During the evening, it was announced that this year's Section prize of Junior membership goes to A. V. Hopkins, of the University of Cincinnati Student Chapter.

CLEVELAND

LIKE OTHER PROFESSIONAL men, the engineer has a distinct obligation to society, George Harding, research professor of civil engineering at Ohio State University, told members of the Cleveland Section at a recent meeting. In Professor Harding's opinion, the engineer can best perform these obligations when his training has included certain character intangibles as well as the "Three R's." Italy and Korea were discussed from the engineer's viewpoint by George B. Sowers, Cleveland consultant, at another meeting. Mr. Sowers, who served as a transport officer with the rank of lieutenant colonel during the war, gave a vivid description of his work, which included evacuating civilians during an eruption of Mt. Vesuvius.

COLORADO

CONSTRUCTION DIFFICULTIES ENCOUNTERED in the building of hidden airfields and bases in enemy-occupied territory, during the war, were described by Col. Wendell W. Fertig at the March 10 meeting. Colonel Fertig said that his unit was handicapped by the lack of trained personnel, adequate equipment, and the right kind of materials. These lacks were responsible for many engineering innovations. Air strips, for instance, were sometimes stabilized by sugar syrup, and much of the equipment was constructed on the ground from miscellaneous collections of supplies and parts. At times fuel for the engines consisted of alcohol distilled from cocoanut palms.

DISTRICT OF COLUMBIA

IN A TALK on constructing the foundations of the South Capitol Street Bridge in Washington, at the March meeting, Kenneth C. Cox, engineer for the Dravo Corp., showed colored motion pictures that he had taken on the job. The film showed the cutting and sinking of nine caissons. Of special interest were the pictures taken inside one of the caissons showing hand excavation to bring it down to final grade. Also of interest were the scenes in which the stone facing was being placed on the piers.

Another recent meeting was devoted chiefly to discussion of recommended revisions of the Section's constitution. The Committee for Cooperation with Technical Divisions reported widespread interest in the creation of engineering subdivisions to stimulate discussion of local papers and increase Section participation in Society affairs. At the April meeting, Capt. Miles P. DuVal, of the U.S. Navy, read a paper on "The Marine Operating Problems of the Panama Canal Involved in Its Modernization and Their Solution" before a capacity audience of almost 400.

GEORGIA

SPEAKING ON THE Puglese Aqueduct in Italy at a recent luncheon meeting, James G. Nichols, former captain in the Army Engineer Corps, cited it as one of the remarkable engineering accomplishments of the Mussolini regime because of the difficulties of terrain overcome in its construction. Running from the Apennine Mountains to the city of Taranto, the aqueduct has a total length of 152 miles. In its entire length, including 1,500 miles of laterals, the aqueduct serves 266 communities and an estimated three million people. The main trunk of the aqueduct depends entirely on gravity flow. Mr. Nichols commanded a division of engineer troops in Italy, during the American occupation.

FLORIDA

ACCORDING TO HYDROLOGIC studies of the central portion of the Florida peninsula, the lakes in the central part of the state would not supply adequate irrigation for the orange groves in the area, Robert M. Angas, Jacksonville consultant, told the members at the March 13 meeting. Mr. Angas revealed many interesting data resulting from the studies. On April 5, the Section went to Tallahassee for a special meeting and inspection of the Federal Correctional Institution. Following a tour of the plant, Warden Alfred Ogram, M. ASCE, described the Institution's method of teaching each inmate a vocation suited to his particular temperament. Then Section President Harold D. Van Vranken led a discussion on the possibility of revising the constitution of the Section to permit the formation of sub-sections. A picnic supper, attended by 210 members and guests, concluded the program.

ILLINOIS

CHICAGO'S RAILROAD PASSENGER terminal problem probably can be solved only through the efforts of a public authority, with powers established by the legislature, according to Joshua d'Esposito, the mayor's representative on the railroad engineers' committee studying the terminal situation. In a talk before the April 9 luncheon meeting, Mr. d'Esposito stated that, in his opinion, the railroads can no longer assume the cost of building railroad terminals together with the tremendous cost involved in the relocation of streets, sidewalks, and other public facilities. The problem is further complicated by the enormous amount of freight to be handled in addition to passengers. A solution to the problem is urgent, he stated, if plans for a terminal are to be coordinated with Chicago's superhighway and subway construction program. The attendance of 110 included 42 members of the Western Society of Engineers.

INDIANA

ENGINEERS SHOULD DEVOTE themselves to national and international affairs as well as to professional matters, ASCE President E. M. Hastings told the members of the Section at their March meeting. Speaking at a joint dinner meeting with the Purdue University Student Chapter, Mr. Hastings emphasized the need for common sense in the application of technical knowledge. "The condition of the world today is such," he pointed out, "that all of us need to devote some of our efforts to a study of our fellow men. The country needs human engineering." A number of Student Chapter members from Purdue University, the University of Notre Dame, and Rose Polytechnic Institute were included in the attendance of 170. During the evening, the Section presented Junior membership awards to Daniel Dunn Meaney, of the Notre Dame Chapter, and William W. Schenler and Milford M. Cheney, of Purdue.

LOS ANGELES

THE PROPOSED AMENDMENTS to the constitution for which petitions are now in circulation—the enfranchisement of Juniors and increasing Society dues—were discussed by Walter E. Jessup, Western Representative of the ASCE, at the March meeting. A symposium on current engineering legislation, with special emphasis on the proposed Professional Engineers Registration Act, aroused considerable interest. The discussion was led by Markham Salsbury, Wallace Chadwick, and Arthur Pickett. The technical program for the occasion consisted of a talk on the United Nations by Dr. J. Eugene Harley, professor of political science at the University of Southern California.

Prior to the regular meeting, the members of the Junior Forum heard Ray L. Derby, senior sanitary engineer of the Los Angeles Department of Water and Power, speak on the functional design of treatment plants. Mr. Derby is vice-president of the Section.

LEHIGH VALLEY

INSPECTION OF THE Fritz Engineering Laboratory at Lehigh University comprised the program for the March meeting. Bruce G. Johnston, professor of civil engineering and associate director of the Laboratory, opened the meeting with a brief talk on the organization and functioning of the Laboratory, after which demonstrations of testing machines and electrical strain-gage measuring equipment were given. The photoelastic technique of stress measurement was also shown and explained. In charge of the tests were Paul Kaar, engineer of tests for the Laboratory; W. H. Munse, research engineer for the Association of Iron and Steel Engineers; and A. T. Yu, research fellow for the Bethlehem Steel Co. W. H. Hiltner, assistant professor of civil engineering, conducted the group on a tour of the hydraulic laboratory.

ITHACA

PRESENT PLANS OF the New York State Department of Public Works call for a six-lane, limited access, divided highway across the state, according to B. D. Tallamy, deputy superintendent of the Department. There will be a speed limit of 70 mph and no traffic lights on this highway, which will be designed to speed traffic through the most heavily populated state in the union. Mr. Tallamy spoke on the proposed New York Throughway before a large joint meeting of the Section and the Cornell University Student Chapter which was held on the Cornell campus on March 24.

MARYLAND

DESIGNS FOR A coal-burning, gas-turbine locomotive are now complete, according to John I. Yellott, director of research, Locomotive Development Committee, Bituminous Coal Research, Inc. In a talk before the March dinner meeting, Mr. Yellott stated that two of the locomotives are being constructed by the Baldwin and American Locomotive works, and it is expected that they will be ready for test runs next year. The research work has centered at the engineering school of Johns Hopkins University. The new locomotive has been designed for main-line operation. Its efficiency approximates that of the diesel electric unit and is about four times that of the conventional steam locomotive, the speaker stated. Since the locomotive will travel a great distance on a small amount of fuel, it will eliminate the present problem of carrying large quantities of coal. Thus one locomotive will be able to make the entire run between such points as Baltimore and Chicago, Mr. Yellott predicted.

ASCE WESTERN REPRESENTATIVE WALTER E. JESSUP is guest of Montana Section at special meeting held at Billings on March 15. Shown, left to right, E. H. Thomas, Secretary, Montana Section; H. D. Comstock, regional director, U.S. Bureau of Reclamation; Mr. Jessup; and W. S. Hanna, district engineer, U.S. Indian Irrigation Service.

MONTANA

ASCE WESTERN REPRESENTATIVE Walter E. Jessup attended the regular March meeting of the Section in Helena on the 14th, and a special meeting in Billings on the 15th. At both sessions Mr. Jessup discussed Society affairs of current interest to the membership, commenting particularly on the two proposed amendments to the Constitution. A number of students from the Montana State College Chapter at Bozeman attended the meeting at Helena. Before the program began, each of the students was assigned to a member, who provided his dinner and was responsible for his enjoyment of the evening. The Billings meeting accomplished one of the ends the Section officers have been working for—namely, to hold meetings at points other than Helena, in the hope of stimulating groups of members in other parts of the state to meet regularly and, possibly, to form sub-sections.

METROPOLITAN

NEW TECHNIQUES in the use of precast concrete for constructing landing craft and storehouses for the Navy during the war were described at the April meeting by Francis R. MacLeay, chief engineer of the Corbetta Construction Co., New York, N.Y. Mr. MacLeay's paper, entitled "Latest Developments in Precast Concrete, with Major Application to Building Construction," was read before a group of about 350 members. In the discussion that followed presentation of the paper, Emil H. Praeger, engineer with Corbetta, described the design aspects of prefabricated concrete construction. During the business session, with Dr. D. B. Steinman presiding, a committee of five was nominated to prepare next year's slate of officers.

MICHIGAN

AIRPORT NEEDS IN the Detroit metropolitan area were discussed at the March meeting by two speakers—Leroy C. Smith, Wayne County highway engineer, and Henry E. Baker, superintendent of the Wayne County Airport. Mr. Smith traced the history of airports constructed and proposed in the area. Commenting on the economics of operation of both the Detroit Municipal and the Wayne County airports, Mr. Smith stated that, considered on a business basis, neither has paid out to date. Plans to extend the present Wayne County Airport were then outlined by Mr. Baker, who stated that the ultimate design contemplates an area of between 2,300 and 2,400 acres, with runway area 40 percent greater than is now provided at the Willow Run Airport. Present plans for extension provide for a 60-deg open parallel design and, when completed, the airport will be the largest in the country.

NORTHEASTERN

THE PHENOMENAL GROWTH of the Society in the past twenty years and the tremendous advances that have been made in helping the younger men in the Society and in increasing the scope of ASCE interests and activities were outlined by ASCE Director Albert Haertlein at the March meeting. Professor Haertlein also called attention to the Society's increased Local Section and Student Chapter activity, its interest in employment conditions, in classification and compensation schedules, and in participation in such joint engineering groups as Engineers Joint Council. This diversified program of activity has naturally entailed an increase in operating funds, the speaker pointed out, urging that the membership sign the petition to bring the two constitutional amendments to ballot.

NORTHWESTERN

DEVELOPMENTS IN THE USE of air-entraining cement were discussed by Carl Menzel, of the Research Laboratories of the Portland Cement Association, at the April 7 meeting. Mr. Menzel illustrated by means of slides and graphs the serviceability of the air-entraining process for concrete exposed to salt solutions. During the evening, a letter from the Junior Forum was read, calling attention to the desirability of having more publicity for both the Juniors and the Section. Paul R. Speer, the new president of the Minnesota Federation of Engineering Societies, outlined the organization's general publicity plan for all the engineering groups in the Federation. The Section went on record as recommending the passage of Senate Bill #360, which would amend the Wagner Act to meet the objections of the professions.

OREGON

A SYMPOSIUM ON engineering laboratories comprised the technical program at the March 20 meeting. The list of scheduled speakers included Irvin A. Cooper, of the Charlton Laboratories, Portland, Ore., whose subject was "Laboratory Control of Concrete Construction"; Harry Czyzewski, of Metallurgical Engineers, Inc., who discussed the role of the metallurgical laboratory in industry; Carl W. Beck, of the Army Corps of Engineers, who spoke on "The Relation of Soils Testing to Engineering Design"; and George A. Guins, of the Albina Engine and Machine Works, Inc., who described hydraulic studies of moving models.

PHILADELPHIA

PROBABLY NO SINGLE factor has had a more significant influence on the American way of life and thought in the past thirty years than the motor vehicle and the highway system, Charles M. Noble, New Jersey State Highway Engineer, told the members of the Philadelphia Section. Speaking on "Broad Aspects of Highway Planning" at the April 8 dinner meeting, Mr. Noble emphasized the changes made in our civilization by the development of the automobile and stressed the necessity of adequate highways. His talk was discussed by E. L. Schmidt, chief engineer of the Pennsylvania Highway Department, and W. A. McWilliams, chief engineer of the Delaware Highway Department. Both explained how their state construction programs are being oriented to fit in with the national program.

PUERTO RICO

A REVIEW OF the engineering problems involved in the design of sewers was given by John M. Hepler, sanitary engineer, at the March meeting of the Section. Mr. Hepler stressed the fact that engineering is essential to the safe disposal of sewage. At another recent meeting, a sound film on "The Making and Shaping of Steel" was shown.

SACRAMENTO

What happens to good paint when applied under adverse conditions was described at the first weekly luncheon meeting in March by Arthur E. Wulff, representative of the New Jersey Zinc Sales Co., at San Francisco. At a subsequent meeting the Section went on record as endorsing proposed state legislation for the adoption of a system of plane coordinates based on the Lambert Conformal projection of the Clarke Spheroid of 1866. At the same meeting, W. A. Huggins, of the Bureau of Accident Prevention of the State Motor Vehicle Department, described the efforts being made by his office to create a sense of social responsibility in drivers, so that they will avoid situations tending to lead to accidents. Creation of this viewpoint, he believes, will be possible in all but about 5 percent of the drivers. The 5 percent are anti-social and cannot be restrained except by arrest.

ST. LOUIS

PROPOSED IMPROVEMENTS TO the St. Louis water works were outlined by Thomas J. Skinker, water commissioner of the City of St. Louis, at the March luncheon meeting. The plan under consideration, Mr. Skinker said, would render better service to the consumer, protect the supply coming from the purification plant at the Chain of Rocks, and provide more economical operation of Water Division plants. This plan—recommended by consultants employed by the city—calls for the modernization of the Chain of Rocks low service pumping station and purification plant; abandoning the Bissell's Point and Baden pumping stations and the gravity conduits from the Chain of Rocks to Baden and Bissell's Point; and construction of a power plant and pumping station at the Chain of Rocks and pressure conduits from the Chain of Rocks to Baden and Bissell's Point and one from Baden to Skinker Boulevard.

SAN DIEGO

THE RAPID GROWTH of San Diego during the war made it necessary to increase the capacity of the present sewage treatment plant, which was placed in operation in 1943. The design of additions being made to the plant was discussed by Frank S. Currie, San Bernardino engineer, at a recent dinner meeting. According to Mr. Currie, the present plant was designed for a population of 260,000, on a basis of 55 gal per capita, while the new plant will serve a population of 500,000 on a basis of 80 gal per capita. Improvements include the substitution of bar screens, mechanically cleaned, for comminutors. Four gas engines, with a capacity of 350 hp each, are to be installed—two acting as standbys, as only two will be required to pump sewage. Better odor control, the speaker stated, is to be obtained by pre-aeration instead of the use of ferrous chloride, and the cost of the preaeration will be less.

SEATTLE

ADDRESSING A RECENT meeting on the status of the Foster Creek Dam Project on the Columbia River, Paul M. Trueblood, senior engineer for the U.S. Engineer Department in charge of investigations, stressed the multiple aspects of the project. The Bonneville Power Administration will market the power, he said. On the basis of 1940 costs, it is estimated that the project will cost about $104,000,000.

TACOMA

LOCATION OF THE proposed Tacoma County–City Airport was discussed at a recent dinner meeting, and a committee was appointed to investigate the several locations under consideration. The technical program for the occasion consisted of a talk by J. A. Gallagher on his experiences with the 116th Engineers in New Guinea and the Phillippines, and talks by two members of the staff of the Boeing Aircraft Co. Stressing the importance of the civil engineer in the aircraft industry, one of the speakers described the many important positions in the field that are open to the engineer. The other speaker described the company's new stratocruiser and showed a film of it.

TENNESSEE VALLEY

IN SPITE OF rainy weather, more than 100 members of the Section and their lady guests attended the two-day spring meeting at Gatlinburg on April 11 and 12. In the absence of Section President Lewis Schmidt, who was ill, Charles DuBois, Vice-President of the Chattanooga Sub-Section, presided over the business and technical sessions. The speakers included George S. Salter, Mid-West Representative of the ASCE, who discussed current Society activities, and R. T. Colburn, whose talk on the design features of the Clark Hill Dam and Power House provoked considerable discussion. E. M. Titus, secretary-treasurer of the Section, presided over the dinner meeting at the Mountain View Hotel on Friday night. The principal after-dinner address—by Frank B. Ward, of the economics department of the University of Tennessee—dealt with some aspects of the labor problem. Colored motion pictures of mountain scenery and flowers were then shown by Arthur Stupka, naturalist of the Great Smoky Mountains National Park. On Saturday Mr. Stupka conducted an automobile tour about the park to see the scenery and early spring flowers.

TOLEDO

THE PROPOSED AMENDMENTS to the constitution were discussed at both the March and April meetings. ASCE Mid-West Representative George S. Salter attended the latter session and outlined the many services the Society now performs for its members that make an increase in dues imperative. In particular, Mr. Salter cited the efforts of the Society to improve the economic and professional status of the engineer and referred to ASCE participation in EJC activities. During the evening, E. E. Smith, of Lima, Ohio, described his engineering experiences while he was with the Allied Military Government.

TRI-CITY

PROBLEMS CONFRONTING A supply officer in preparation for major military operations were discussed by Col. William N. Leaf, district engineer of the Rock Island Engineer District, at a recent joint dinner meeting with the Engineers Club of Iowa City. Colonel Leaf, who was commanding officer of the 592 Boat and Shore Regiment in Australia and New Guinea, stressed the importance of engineering in amphibious operations.

WISCONSIN

CHANGES OCCURRING WITHIN the Society, as it develops from a static honor organization into a dynamic service society, promoting the professional, technical, and economic advancement of the civil engineer, were emphasized by ASCE Mid-West Representative George S. Salter at the March dinner meeting. Speaking on the two proposed amendments to the constitution, Mr. Salter showed that the Society cannot continue the new type of service it gives its members without an increase in operating funds. The technical program consisted of talks on soil conservation practice, given by staff members of the Milwaukee headquarters of the Soil Conservation Service—R. H. Musser, Edwin Freyburger, and M. M. Culp. An inspection tour of the offices and laboratories of the Soil Conservation Service preceded the dinner meeting. The attendance of 80 included several members of the Marquette University Student Chapter.

STUDENT CHAPTER Notes

COLLEGE OF THE CITY OF NEW YORK
(The Dam Club)

ALTHOUGH THE DAM CLUB, an organization of graduate City College engineers, is not a Student Chapter, members will be interested to hear that it was recently reactivated after a period of wartime inactivity. The Dam Club was organized in 1936 by a group of City College civil engineering students of the late Prof. Frederick O. X. McLoughlin, a founder of the School of Technology there. One of the main purposes of the club is to assist in the progressive development of the school and to participate in the extracurricular activities of the civil engineering students. A full program of social and technical activities has been planned for the year.

NEW YORK UNIVERSITY

AT THE FIRST MEETING of the spring term, a program of diversified activities was arranged for the rest of the semester. High priority in the planning has been given to smokers and field trips to civil engineering works under construction in the New York area. Guest of honor and speaker at the first of these scheduled smokers was D. B. Steinman, New York City consultant and president of the Metropolitan Section. Dr. Steinman supplemented his talk on the aerodynamic instability of suspension bridges by showing a motion picture on the failure of the Tacoma Narrows Bridge and by the use of scale models to illustrate the aerodynamic effects of wind in various types of bridge sections.

The Chapter is issuing a mimeographed publication, entitled "On the Level." A typical issue contains several student articles on engineering subjects, special notices, and Student Chapter notes.

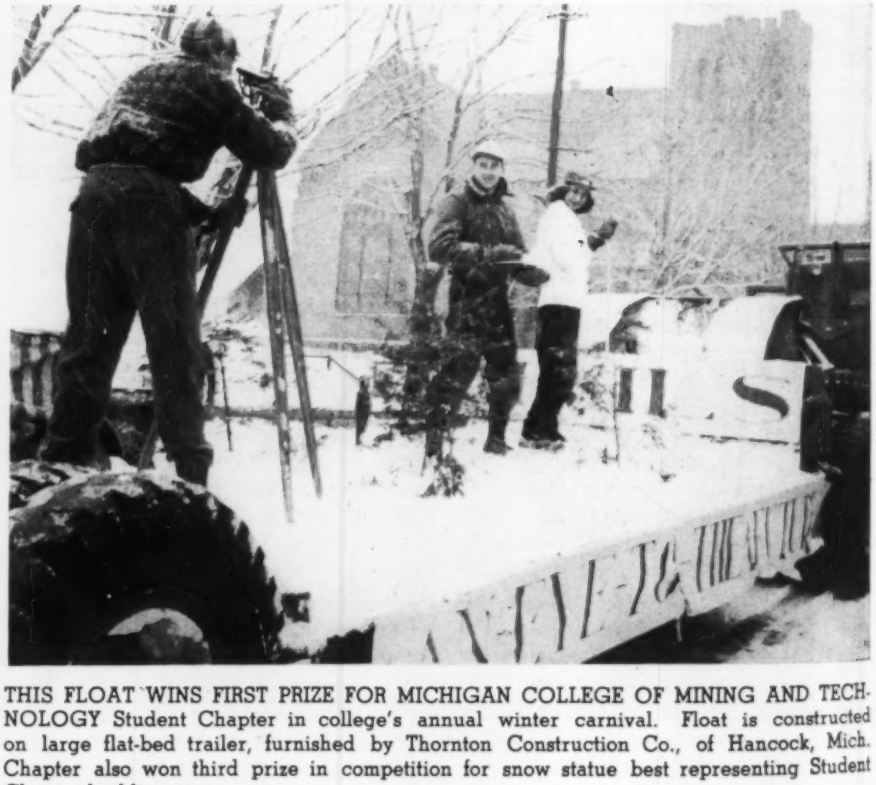
UNIVERSITY OF WISCONSIN

THE UNIVERSITY OF Wisconsin Chapter is enjoying a spring program of technical and social activities. Speaker at a recent meeting was Jesse C. Dietz, research assistant in civil engineering at the university and former lieutenant colonel in the Army Corps of Engineers, who described his experiences while constructing military airfields in the European theater. Members of the Chapter participated in the university's annual St. Patrick's Day celebration, and plans are under way to take part in the regional meeting of the ASCE, to be held at the Wisconsin Memorial Union on April 24.

H. B. BLODGETT ACCEPTS WATCH PRESENTED by Ernest L. Buckley in behalf of South Dakota State College Student Chapter. Seated at left of Professor Blodgett is Kenneth R. Scurr, principal speaker, and at right of Mr. Buckley is Prof. H. B. MacDougal.

SOUTH DAKOTA STATE COLLEGE

AT A RECENT student smoker H. B. Blodgett, former head of the civil engineering department at South Dakota State College, was presented with a 17-jewel Hamilton watch by members of the Student Chapter. The presentation was made by Ernest L. Buckley, Chapter president, in appreciation of Professor Blodgett's work at the college during the past 17 years. Professor Blodgett was head of the department for 10 years, resigning at the end of 1946 to accept a position as head of the civil engineering department at the University of Nevada. Speaker of the evening was Kenneth R. Scurr, South Dakota state bridge engineer. There was an attendance of about 200 students and faculty members at the dinner and smoker.



THIS FLOAT WINS FIRST PRIZE FOR MICHIGAN COLLEGE OF MINING AND TECHNOLOGY Student Chapter in college's annual winter carnival. Float is constructed on large flat-bed trailer, furnished by Thornton Construction Co., of Hancock, Mich. Chapter also won third prize in competition for snow statue best representing Student Chapter building it.

NEWS BRIEFS

ABOUT ENGINEERS AND ENGINEERING

Better Highways for Less Money Is Aim of Contractors and Engineers

WORKING TOWARD A COMMON GOAL, the building of better highways for the public for less money, both contractors and engineers share responsibility for achieving this aim, according to Dwight W. Winkelman, vice-president, The Associated General Contractors of America, who spoke before a recent meeting of the New York State Highway Engineers' Association in Buffalo, N.Y. Discussing engineer-contractor relations, Mr. Winkelman said that "Most responsible executives of contractors' organizations also were educated as engineers, trained in the same kind of thinking and talking the same language."

Other extracts from Mr. Winkelman's talk follow.

"The first step in promoting better relations between engineers and contractors—which will result in better and cheaper highways—is an attitude of mutual respect and understanding. For the most part that exists today. I believe there is room for improvement, however, by both parts of this highway team.

"Let me cite two examples. During the past year there was a disposition on the part of highway contractors throughout the country to complain of the careful examination that state highway departments and the Public Roads Administration gave to bid prices when they were a certain percentage above prewar costs for comparable work. Yet by that careful study and careful awarding of contracts, these agencies were able to show the executive departments and legislatures of states or the federal government that public funds were being spent wisely for highways. A willingness to understand the problem of the highway department will allow the contractor to see that this carefulness probably prevented a drastic curtailment of highway work.

"From the contractor's point of view, I might also add that the PRA policy of a percentage ceiling on bids probably led to a better understanding by engineers of contractors' costs.

"In these days when bid prices exceed those of prewar times, there is a tendency to suggest that the contractor must be making an exhorbitant profit. A recent survey by the Dun and Bradstreet Review may interest you It showed that the average profit for contractors is 1.42 percent, while the average for other businesses in the survey was 3.99 percent—more than double that of the contractor. I hope you have a willingness to understand that a contractor is not gouging anyone with a 1.42 percent profit.

"The more specifications are left open to the discretion or determination of the engineer, the more the contractor must add contingencies to offset his possible whims. Consequently the more the construction will cost.

"In the six meetings of the Joint Cooperative Committee of the American Association of State Highway Officials and the Associated General Contractors of America, one subject always arose. That was the administration of contracts with a strictness beyond all reason. Examples were cited, such as requiring the contractor to sprinkle concrete during the rain, or heating it during winter and spring months even though the thermometer might go to 72—just because the specifications required the contractor to do these things.

"If contractors could always expect a reasonable and understanding attitude in the administration of contracts, bid prices could be lower.

"Another specific way to hold down costs is for engineers to avoid the temptation to specify both the results and the methods. Where suitable alternate routes are not available, results must be specified to the extent of requiring the highway to be rebuilt while traffic is maintained over it. But where the engineer also specifies the method, he must assume responsibility for the result. And he must also assume responsibility for depriving contractors of the opportunity to devise a more efficient and economical method.[1] One of the powerful forces for efficiency and economy in highway construction is the competition between contractors in developing better methods.

"Some items of highway costs are within the control of contractors. Others are not. Some can be influenced by cooperation between engineers and contractors. Highway costs now are higher than before the war. So are all other costs. Actually, costs of highway construction have increased less than many other costs. I would like to make the following observations with respect to costs:

"1. Highway costs will not go down if construction programs are halted or drastically curtailed. An idle contractor does not gain in efficiency. Construction should proceed on a moderate but increasing scale on projects where adequate competition indicates a fair price.

"2. Understanding is required by state, county, city, town and other governmental units that wars are inflationary and prices never recede to previous levels.

"3. Efficient and economical construction will require cooperation from labor in keeping wage rates in line and in increasing productivity.

"4. Such construction will require cooperation from equipment and materials producers and suppliers. Increased mechanization, incidentally, will be an important factor in developing more economical methods.

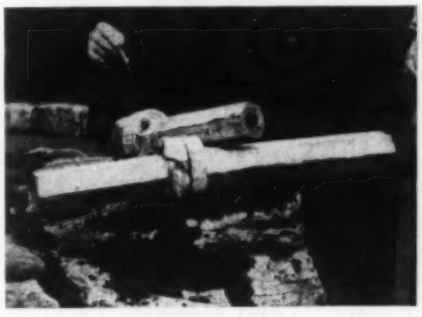
"5. Cooperation between engineers and contractors will be important in improving design, specifications, and administrative procedures to permit more efficient operations.

"6. Contractors will have to keep improving their methods and increasing their efficiency.

"7. And finally the way must be kept open for competition between contractors. I believe that is the strongest single force for developing efficiency and economy in highway construction."

[1] See "Good Records Make Good Witnesses," by Oren C. Herwitz, page 37 of this issue.

CENTURY-OLD PIPE



FIRST MACHINE-MADE CLAY PIPE, still in excellent condition although almost century old, is unearthed in Beechwold Section of Columbus, Ohio, by city engineering department. Pipe—used for small water and sewer pipe—has 1 1/2-in. inside diameter, bored by special machine after molding. Flanges made by hand and fired integrally with body permit sections to be bolted together.

New Silicon Compounds Will Give Increased Life to Roads

BETTER HIGHWAYS through use of a new class of organic chemical compounds containing silicon, the principal element in sand, were predicted by Dr. C. S. Miner, Jr., L. A. Byran, R. P. Holysz, Jr., and Dr. G. W. Pedlow, Jr., of the Miner Laboratories, Chicago, in a paper presented at the 111th national meeting of the American Chemical Society.

Aggregates used to reinforce asphalt are made water-repellent by treatment with one of the new compounds and adhere better to the asphalt, according to the report, which declared that "roads so constructed will have increased life and resistance to stripping."

Opportunities in the Philippines Are Open for U.S. Contractors

AMERICAN CONTRACTORS MAY undertake construction work in the Philippines under the Rehabilitation Act of 1946 on an equal footing with Filipino contractors, Thomas H. MacDonald, Hon. M. ASCE, Commissioner of the Public Roads Administration, Federal Works Agency, has announced. The announcement is based on a recent opinion of the Philippine Secretary of Justice, who also ruled that American contractors will be permitted to take equipment and supplies to the Philippines subject only to the same taxes as those imposed on Filipino contractors.

Under recent free-trade legislation and by agreement between the Public Roads Administration and the Philippine Government, no import taxes will be levied on equipment and supplies taken to the Philippines by American contractors for use in road construction under the Philippine Rehabilitation Act. Contractors may also take key personnel to the Philippines without regard to immigration quotas.

For contracts financed entirely by the Philippine Government, foreign contractors are required to employ a registered Filipino engineer to be in complete charge of the work. American contractors are released from this requirement when engaged in work under the Rehabilitation Act.

Ten million dollars has been allocated for highways in the fiscal year 1947 in the Philippine rehabilitation program. Eighteen construction projects have been approved so far, at a total estimated construction cost of $4,285,500. Included in this approved program are four projects for high-type pavement construction, totaling 21 miles in length, and ten projects for 25 bridges ranging in span from 23 to 336 ft; also four force-account projects for bituminous mat and seal, totaling 29 miles in length, which are already under way.

U.S. Chamber of Commerce Opposes Federal Housing

REPRESENTING THE CHAMBER OF COMMERCE of the United States, which he serves as chairman of its construction and civic development department committee, George W. West, of Atlanta, Ga., expressed opposition of the National Chamber to the Taft-Ellender-Wagner Bill, S. 866. Following are some of Mr. West's statements.

"Our opposition to S. 866, and to other bills of similar nature now before this committee, is based primarily upon a fundamental conviction that the improvement of housing is by its nature an activity which should be carried out by the people of each community.

"The National Chamber is in full accord with the desirability—more than that, the necessity—of improving the standard of housing in our communities. We hold no brief for slums. But we cannot agree with the proponents of this legislation that the way to improvement is to set up an elaborate and expensive establishment in Washington to administer large federal subsidies. This method has been tried and found wanting.

"In its present form S. 866 calls for an expenditure of well over $6 billion over a period extending as far as 45 years into the future. While this money would be used for a number of purposes, the net accomplishment in terms of low-rent dwelling units is set at accommodations for 500,000 families under the limitations of Title IX of the bill itself. This would take care of less than $1\frac{1}{2}$ percent of the 38 million families in the nation.

"Estimates of the number of families now living in substandard homes vary widely, depending upon the definitions used, but they range from a low of 2 million families to a high of over 12 million families. Whatever figure is accepted, it is apparent that federally subsidized construction on the scale contemplated in the pending bill cannot begin to meet the need. Either the contemplated housing program must be much larger and more expensive, or the federal program will be open to the same accusation now levied against private industry by the proponents of public housing: failure to do the job.

"The fact that the budgetary situation will not permit the use of federal funds for government housing does not mean that we must continue slum conditions. All over the country, communities are actively exploring the possibility of remedial measures, utilizing their own resources.

"A decision by the federal government to keep out of this field would serve to stimulate additional efforts by local and state governments. Furthermore, as the private building industry gets into its stride in providing new housing accommodations, more and more older but still useful dwellings will become available for those unable to build for themselves."

Virginia Plans 31-Million Road Improvement Program

ENGINEERS OF THE Virginia State Highway Department, gathered together in their annual all-day session in Richmond recently, heard L. E. Akers, assistant maintenance engineer of the department, outline the $31,000,000 improvement program for Virginia's secondary road system which began January 1, 1947. During the 18-month period following that date, $17,700,000 will be available for construction work, $4,600,000 for maintenance replacement, and $8,700,000 for ordinary maintenance, Mr. Akers stated. Objectives for the period include new hard surfacing on 2,055 miles of secondary routes, 3,000 miles of new stabilization, 408 new bridges, and 2,050 miles of surface retreatments.

Mr. Akers explained the long-range plan for the development of Virginia's secondary roads, which includes: (1) Oiling of all roads carrying 50 or more vehicles per day; (2) an all-weather surface on all school bus routes and other roads carrying from 10 to 50 vehicles; and (3) for roads other than school bus or mail routes carrying less than 10 vehicles, such improvements as possible with the funds available, but a minimum improvement of $50 per mile per year.

Peruvian Engineers Praise Our Customs and Institutions

GREAT ADMIRATION for the engineering achievements of the United States is expressed by two Peruvian engineers, Don Juan Quiroga and Eduardo A. Salgado, who recently visited this country at the invitation of the Office of Inter American Affairs. Their views are based on observations made while inspecting highway construction and maintenance work on an extensive tour.

A radio script of their reaction to U.S. customs and institutions has been prepared by Dr. Quiroga, chief of the Puruvian Technical Department, to be broadcast over the Peruvian National Radio on May 23 at 10:30 p.m. (Peruvian time). Information obtained from a copy of the script submitted to ASCE Headquarters by Gabriel Lund, M. ASCE, indicates that one of Peru's greatest needs is good transportation to enable her to develop her rich mineral resources.

It is not only our systems of transportation that excite the admiration of this cultured Peruvian, who states that "the fertile and generous land of North America is the foundation of its wealth and extraordinary progress." Another interesting statement made by Dr. Quiroga may come as a surprise to many critics of the average American. "We believe that the basic contribution of the North American to the progress of his country can be expressed in a single word—work." He continues that although the peoples of Spanish origin consider work to be a curse imposed on man for his disobedience of divine principles, the North Americans have exalted work, inculcating a love of it even in their children, with the result that they have made great contributions to progress.

Dr. Quiroga is impressed by the fact that in all manufacturing establishments and engineer-departments, the mere doing of work is not considered enough. "Always," he says, "they try to improve production and reduce costs, using technology to get the desired results.... In all factories of any importance there are magnificent laboratories.... In the United States they do not conceive of highway offices, of engineering schools or universities, without laboratories."

Dr. Quiroga speaks gratefully of the professional cooperation he received in the United States and praises North American hospitality in glowing terms. His radio script concludes, "Let us imitate the example of the United States, which exalts and technicalizes labor in an atmosphere of liberty."

Aeronautical Research Positions Available

ENGINEERS who have performed research work in problems relating to aeronautics and who have had from 1 to 3 years of professional experience may be interested in openings now available for positions in the Aeronautical Research Scientist series with the National Advisory Committee for Aeronautics.

The U.S. Civil Service Commission is accepting applications for probational appointment to positions paying from $3,397 to $9,975 per year. Ratings will be made on an evaluation of education and experience. No written test is required.

Information and application forms may be obtained from the U.S. Civil Service Commission, Washington 25, D.C.

Irrigation in Arizona Is Lowering Groundwater Level

WELLS SUPPLYING WATER for irrigation of the Wellton-Mohawk area in Arizona have lowered the underground water table 18 ft within the past 20 years and have caused such an increase in concentration of dissolved mineral matter in the water reservoir that the suitability of the water for continued agricultural use is seriously threatened, according to W. E. Wrather, Director of the Geological Survey, Department of the Interior.

A report by the Geological Survey points out that sand and gravel beds underlying the area form a natural underground reservoir from which all the water used for irrigation is pumped. In 1945, 35,000 acre-ft of water was pumped to irrigate the 7,000 acres under cultivation. The amount of water annually discharged is much greater than the amount recharged.

The excessive lowering of the water table and the increasing chemical concentration of the water show that the safe annual yield has been greatly exceeded, both from a quantitative and from a qualitative standpoint. About 14,000 acre-ft more water is withdrawn each year from the groundwater reservoir than is recharged. The lowering of the water table and the increasing salt concentration of the groundwater point to a continued decline of agriculture in the area. There is no way of improving these conditions except by the addition of water of low chemical concentration.

The report, "Geology and Groundwater Resources of the Wellton-Mohawk Area, Yuma County, Ariz.," was issued as a part of a cooperative study by the Geological Survey and the Arizona State Land Department, O. C. Williams, commissioner. The study was requested by a special session of the State Legislature in September 1945 to investigate the groundwater resources of each important basin in the state. A limited number of copies have been mimeographed and are available to those especially interested in the Wellton-Mohawk area, at the office of the Geological Survey, 408 North Fourth Avenue, Tucson, Ariz. Copies may also be consulted at the office of the State Land Commissioner, Capitol Annex, Phoenix, and at the offices of the Geological Survey in Phoenix, Ariz., and Washington, D.C.

NON-HOUSING CONSTRUCTION IS $566,363,000 IN 12 WEEKS

Non-housing construction approved during the 12-week period from January 10 to April 3 totals $566,363,000, a weekly average of $47,197,000 as against a weekly permissible average of $50,000,000, according to the Office of the Housing Expediter. During the last week of that period, 2,233 applications were approved for a total of $57,877,000, while 1,053 applications were denied for a total of $22,823,000.

From March 26, 1946, when the construction authorization order (VHP-1) went into effect, to April 3, 1947, 93,373 applications were approved for a total of $3,076,365,000 while 60,646 applications were denied for a total of $2,194,530,000.

Swedish Students React Favorably to Tour of U.S.

REPORTED IN THE BULLETIN of The American Society of Swedish Engineers, Winter 1946–1947, is the favorable reaction of the 32 students from the Royal Institute of Technology in Stockholm, Sweden, who last summer toured American technical universities and points of engineering interest.

Axel Ekwall, technical adviser to the Swedish Legation, who reported the trip in the Bulletin, comments as follows:

"The tour included many interesting visits to American universities, where these students from Sweden always found hospitality and met congenial American students. It was said more than once that there should be more such study trips by engineering students, not only from Sweden to the United States but from this country to Scandinavia as well. The young students could then see for themselves how their science is international and that people on the other side are not so different."

British Industries Fair to Show Wide Range of Goods

A DOMINANT FEATURE of the 1947 British Industries Fair, which opens simultaneously in London and Birmingham on May 5, will be a 30-ft lighthouse of 4 million candlepower which is being erected inside the halls of Olympia, famous exhibition site in London. Already singled out as one of the outstanding exhibits, the lighthouse will be eventually shipped to Ytteroerne, on the Norwegian coast, to replace one taken away by the Germans. There its special "triple flash" will be visible 40 miles away.

Many other scientific and precision-built equipment items, embodying fine craftsmanship and engineering skill, will be shown at the London section of the fair, as will be plastics, textiles, and other light industries. Engineering and hardware industries will be shown in the Birmingham section.

First held in 1915, the British Industries Fair has attracted thousands of visitors from abroad annually. In 1939, the last year it was held, it was visited by nearly 7,000 overseas buyers. This year a still greater number is expected, because of the long period since the last fair and because the range of goods on display will be larger than ever. This represents a remarkable achievement, considering that industry will have had only 21 months in which to make the switch-over from war to peace production.

Applications for stands have been far in excess of the space available and constitute a record in the fair's history. A record number of 3,131 manufacturers will occupy 835,000 sq ft. Eighty separate trade groups will be represented, and only goods produced in Britain, the British Commonwealth and other British countries may be shown.

Intensive Campaign for Traffic Safety Advanced

ACCORDING TO THE Annual Report of the National Committee for Traffic Safety, the year 1946 was perhaps the most significant in the history of the quest for safe highways. A numerical traffic fatality record, which threatened to eclipse the peak established in 1941 was suddenly halted. Although more persons were killed on our highways than in 1945, the rate per mile dropped after April, with an estimated saving of 6,000 lives and over 100,000 injuries.

In seeking the cause of the lowered accident rate per mile, the National Committee for Traffic Safety concludes that better safety education, more adequate enforcement, and organized public support have been contributing factors in the reversal of the trend. Significant, also, is the fact that the downward trend began in May, the month of the President's Highway Safety Conference. For details of this year's conference, see page 56 of the April issue.

During the past year, the Committee has been increasingly active as a coordinating agency, having brought many groups together for mutual assistance in traffic safety programs. It has also issued 12 regular editions and one special edition of its newsletter, *Spotlighting Traffic Safety*, and 34 special bulletins, and distributed approximately 25,000 pieces of literature on traffic safety.

Publications cited by the Committee as being alert to the traffic safety situation include: *The Casualty & Surety Journal*, published by the Association of Casualty & Surety Executives; *Do You Know These Facts About Vision?* a factual presentation of the relationship between vision and accidents, published by the American Optometric Association; and *Hold That Line*, issued by the United States Junior Chamber of Commerce as a service to its affiliated organizations.

R. Robinson Rowe, M. ASCE

"I SUPPOSE," mused Professor Neare, "that most of you have read the papers and wondered at the wide variety of schemes and estimates for the Friscoak Toll Bridge, but did it occur to you to wonder why people will spend millions to live at one end of a bridge and work at the other?"

"Just to keep bridge engineers from starving, Noah," retorted Ken Bridgewater, "I treated the office to a steak dinner when the Chief ordered us to double the estimate, the interest rate, the revenue and the amortization period on account of inflation."

"I don't think you can do that," said Joe Kerr. "Neglecting the small interest, the amortization period wouldn't change if cost and revenue were doubled."

"That interest isn't peanuts," jeered Cal Klater. "The doubling process just tentupled it from $30 million to $300 million. I'll show you. Letting the 4 factors in order before doubling be C, i, R and n, the general formula for annual payments is

$$Ci = R[1 - (1 + i)^{-n}]$$

and after doubling we have

$$2C2i = 2R[1 - (1 + 2i)^{-2n}]$$

which can be combined to eliminate C and R. Then with $i = 0.02$,

$$2{\cdot}1.02^{-n} - 1.04^{-2n} = 1$$

This has to be solved by cut and try to find $n = 30.629$ yr. Now R was given as $4 million, so we can substitute back in the first equation and find C = $90.95 million, but the total revenue was $122.52 million, so the interest exceeded $31 million."

"That's the answer," admitted Ken, "only we figured semiannual payments and found C = $91.11 million."

"Daily payment gives a direct solution without cut and try," added Professor Neare. "The general formula is

$$Ci = R(1 - e^{-ni})$$

where e is the natural base. Applying it to the doubled factors and eliminating C and R as before, we get a quartic

$$x^4 - 2x + 1 = 0, \text{ where } x = e^{-ni}$$

This has a trivial solution, $x = 1$, and two imaginary solutions, but the fourth can be found by Cardan's Method and substituted in the general formula to give

$$C = \frac{200}{3}\left(4 + \sqrt[3]{3\sqrt{33} - 17} - \sqrt[3]{3\sqrt{33} + 17}\right) = \$91.26 \text{ million}$$

Incidentally, this is the simplest way of figuring amortization over long periods, but financiers detest it.

"At the Phoenix Meeting, L. A. Bridger showed us a good problem and I coaxed him to be our Guest Professor. His is a tall tale, but teasing."

"Too terribly true, Noah. When I built the bridge over the Amazon River, I built a snake-proof platform $ABCD$ (see Fig. 1)

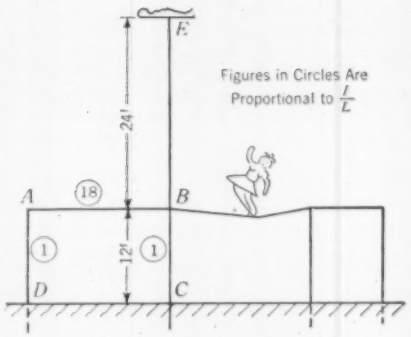


Fig. 1. Bridger's restful perch.

near that of a village Chief. It was rather shaky, as you can see from the relative stiffnesses, but when the Chief's daughter strung a liana from her platform to mine and practiced tight-rope dances half the night, I couldn't sleep. Ingeniously I replaced pole BC with mast CE, reinforced pole AD and tightened lashings until joints A and B were rigid. Greasing the pole behind me, I climbed to a platform on C, which had no lateral motion, and so slept soundly thereafter. How stiff did I make AD?"

[Cal Klaters were the anonymous A. Nuther Nutt and Richard Jenney. As you might guess from his nom de badin, Guest Professor L. A. Bridger is Ralph W. Stewart.]

Was Hoax Perpetrated by Galileo and Newton?

The following comment is offered by hydrometeorologist Walter T. Wilson, Assoc. M. ASCE, on the scholarly treatise of Anne Othernutt, in the March issue of CIVIL ENGINEERING, in which he exposed the Newton Gravity Hoax.

IT SHOULD BE pointed out to Anne Othernutt, the author of "Is Theory of Gravity World's Biggest Hoax?" that a cable such as he describes would be under compression rather than tension from the gravitational forces. Even with a radius as great as 355 miles, the slenderness ratio would be excessive. A colleague of mine (Mr. F. A. Bertle, Jun. ASCE) has suggested that the use of a cable would require it to be fastened to the side of the moon opposite from the earth. Inasmuch as the other side of the moon has never been observed, the existence of such a cable might appear plausible. In fact the restraining influence of the cable might be the very reason the moon does not rotate about an axis.

The other end of the cable leads to an awkward problem, however. Galileo tells us that the moon rotates around the earth. It seems unreasonable to accept such a hypothesis. Imagine the moon describing an orbit about the earth, with a huge cable—perhaps with a sky hook on the far end—whipping about and flailing the ether on its circuit.

Everyone knows that the earth rotates around the sun, in spite of the casual impression that the sun rotates around the earth as it rises and sets. It is obvious to anyone who has observed the moon, that it follows roughly the same apparent path around the earth as does the sun. Therefore, knowing what we do about the sun, it is clear that the earth also rotates around the moon. This conveniently removes the necessity of holding the moon in place, but now what holds the earth in place? Instead of a cable to hold the moon at its distance, the requirement now is to hold the earth, with a mass 80 times that of the moon. With the inverse square law of gravity, the radius of the hypothetical cable would be 355 times 80, or 28,400 miles, which is preposterous. This compels the conclusion that not only Newton but also Galileo perpetrated a hoax. They may even have been in cahoots.

Slight Error Might Upset Equilibrium of Universe

IN WAY OF COMMENT on the foregoing treatise I wish to state that Mr. Wilson is fundamentally correct in his enlargement of the idea of gravity being non-existent.

The high value of the slenderness ratio is easily explained. According to Euler's formula it is the product of E and the slenderness ratio that counts. Here E approaches infinity, as every one who has had any experience with "habit," the material of which the cable is made, knows and can readily testify.

The method of fastening a cable of 56,800 miles diameter to the earth, and the side of the moon to which the same cable is attached are problems for the detailers to work out. That the forces at the two ends of the cable are unequal simply shows how careful one must be in dealing with these enormous forces. A slip might upset the equilibrium of the whole universe.

That Galileo tried to sell the idea that the earth goes around the sun is well known. He was put in the clink for pulling that one, and it was Newton, as Mr. Wilson suggests, who showed him the way out.—Anne.

Latin American Engineers Study U.S. Highway Practice

TWENTY HIGHWAY ENGINEERS and construction men from the Latin American republics are enrolled in a training program undertaken by the American Road Builders' Association in response to an invitation

from the Office of Inter-American Affairs. For more than 15 years the ARBA, through its Pan American Division, has sponsored annually an educational program providing for the training of some 30 Latin American engineers in highway construction, maintenance, etc. The present program is somewhat similar though on a broader scale. Cooperating agencies in addition to the Office of Inter-American Affairs are the Department of State, the Public Roads Administration and the Pan American Highway Confederation.

A carefully planned program has been mapped out to provide the specialized training and practical experience required to familiarize the visitors with American highway equipment, materials, methods, construction, maintenance and operation so that they will be able to put the knowledge thus acquired to practical use in their own countries.

The course covers a period of nearly a year, beginning April 1, 1947, and ending March 7, 1948. About eight months of this period is allotted to individual assignments, the rest to lecture courses, the President's Highway Safety Conference, an inspection and study tour, Yale University highway traffic course, etc. Many state highway departments and other public bodies, as well as commercial and industrial organizations, are contributing in one way or another to the course.

Meetings and Conferences

Mid-America Exposition. A $100,000 display of atomic energy in action will be the central theme of the 1947 Mid-America Exposition, to be held in the Public Auditorium, Cleveland, Ohio, May 22–31. Arrangements have been made in cooperation with the United States Atomic Energy Commission. The Cleveland display will show the peacetime applications of the development, and the atom will be split through the use of a special model of the cyclotron.

President's Highway Safety Conference. This year a meeting of the Action Group of the President's Highway Safety Conference—to be held in Washington, D.C., June 18-20—will be substituted for a general conference. Purpose of the meeting will be to inventory accomplishments to date, and to devise additional means of promoting wider adoption of the "Action Program" by the states and communities. Inquiries should be addressed to the President's Highway Safety Conference, Action Program, 7009 Federal Works Building, Washington 25, D.C.

The Society of Naval Architects and Marine Engineers. Arrangements have been made to hold a spring meeting at the Hotel Statler in Washington, D.C., on May 23 and 24. The program will include visits to the David Taylor Model Basin, the Naval Research Laboratory, and the Naval Engineering Experiment Station. Registration is from 8 a.m. to 9 a.m. on Friday, and from 7:30 a.m. to 8:30 a.m. on Saturday.

Wool Gatherings by WOOLLEY

A NEW PHOTOELECTRONIC INSTRUMENT, which can automatically count individual smoke particles or bacteria as small as 25 millionths of an inch in diameter and weighing only 4 millionths of a billionth of an ounce, has been developed in the chemistry department at Northwestern University.

PRODUCTION OF POWER by all electric utilities during 1946 is estimated at 222,500,000,000 kwhr.

A DELEGATION FROM 35 COUNTIES in East Tennessee has asked for legislation to give the counties more money from TVA to "take the place of taxes we lost when TVA took over property in the respective counties."

TWO HUNDRED YEARS AGO Benjamin Franklin wrote of his experiments with the electric kite, from which he deduced the electrical nature of lightning.

THE ARMY QUARTERMASTER CORPS has invented a match that will light readily after being in the water for as long as six hours.

A TYPE OF FLOODLIGHT using three 1,000-w water-cooled mercury lamps, each smaller than a cigarette, will illuminate an area of 100 sq ft with the brightness of daylight.

A GLASS OF WATER put into a pressure chamber set for 18,000-ft altitude will bubble like a glass of beer. Something similar happens to a pilot's blood when he rises suddenly to high altitudes, though gulps of oxygen help minimize it.

BETWEEN SEPTEMBER 1, 1945, and September 30, 1946, more than 124 million man-days were lost because of strikes. This means for an 8-hour day at $1.00 an hour more than $998,000,000 lost in direct wages alone—to say nothing of the infinitely greater loss in production of goods, related layoffs in other industries, etc.

A LIST OF 864 STANDARDS approved for national use of industry by the American Standards Association was recently made public.

ABOUT TWO-THIRDS of our American water works systems use groundwater as a source of supply.

DURING THE FOUR WAR YEARS the total war casualties were less than a third as many as the casualties caused by traffic accidents.

THE AREA OF THE PACIFIC OCEAN and its dependent seas is about equal to the entire land surface of the globe.

SEVENTY-FOUR PERCENT of Algeria is desert.

MONEY IN CIRCULATION now totals $93,000,000,000 more than before the war.

VENICE HAS MORE than 150 canals and nearly 400 bridges.

Council Created to Prepare Building Code for Iowa

EFFORTS OF IOWA ENGINEERS to secure a Uniform State Building Code have resulted in substantial progress. The Iowa Legislature has passed a Joint Resolution creating a Building Code Council whose function is to prepare such a code for submission to the Fifty-Third General Assembly of Iowa when it convenes in 1949.

Identical joint resolutions setting up the Building Code Council were introduced in the State Senate (S.J.R. 3) and the House of Representatives (H.J.R. 5) and passed in the former by a vote of 45 to 0, and in the latter by a vote of 93 to 1. Governor Robert D. Blue signed the bill on March 21.

Successful passage of this bill marks the cuimination of three years of consistent legislative effort, with all the hard work that goes with it, according to Frank Kerekes, M. ASCE, chairman of the State Building Code Central Committee. Among the organizations supporting the work for a Uniform State Building Code is the Iowa Section of ASCE.

St. Louis Park Competition Is Open to Engineers

DEVELOPMENT OF A NATIONAL PARK on the St. Louis, Mo., waterfront is being stimulated by the Jefferson National Expansion Memorial Association, which has $225,000 with which to conduct a national competition for proposed plans for the park. At the request of the members of the St. Louis Section of ASCE, George Howe, consulting architect of the Memorial Association, has advised the City Plan Commission of St. Louis that the competition will be open to civil engineers as well as to architects.

Many Foreign Students Are Studying Engineering in U.S.

FOREIGN STUDENTS totaling 3,133 are studying engineering in more than 300 universities and colleges in every state of the United States and the District of Columbia, according to a roster published by the Department of State. Almost all are here at their own expense or through scholarships provided by their respective governments. They represent nearly one-fifth of the 17,000 foreign students now taking a wide variety of subjects in U.S. educational institutions.

The roster was compiled by the Division of the International Exchange of Persons of the State Department's Office of International Information and Cultural Affairs at the request of the Engineers Joint Council of New York. The Council, which represents five national engineering societies with a membership of 90,000, including ASCE, plans to conduct the foreign students on local tours of engineering projects through 260 local chapters in all parts of the United States.

NEW IN Education

EXPANSION OF RESEARCH by industry and an immediate shortage of trained personnel for industrial and scientific research were foreseen by Dr. A. B. Kinzel, chairman of the Board of the Engineering Foundation, in the Foundation's 32nd annual report to the Board of Trustees. The shortage of research personnel will be relieved, Dr. Kinzel predicted, as more students undertake graduate work in universities, which at present are inadequately staffed because of the competition for trained men between the government and industry. "It is clear that industry has, in general, become more research minded, and large expansions of industrial research are to be expected," he said. "In some cases this will be by individual companies, in others, by associations of various types."

ONE OF the first non-medical grants by the U.S. Public Health Service has been made through the National Institute of Health to the Georgia School of Technology for a three-year project on fundamental research in water and sewage analysis. About $20,000 has been made available for the first year's work.

This project will be conducted in the new sanitary engineering section of the Department of Civil Engineering under the direction of George W. Reid, Jun. ASCE, associate professor of sanitary engineering, who will be assisted by Dr. Robert S. Ingols, Research Associate Professor of Sanitary Chemistry, in addition to full-time graduate and student assistants. Dr. C. E. Renn of Johns Hopkins University will collaborate.

A PROGRAM OF INTENSIVE TRAINING for veterans and retail lumber and building material yard personnel has been developed jointly by the Georgia School of Technology and the Lumber and Supply Dealers Council of Georgia, with the copperation of the National Retail Lumber Dealers Association. This industry-sponsored program consists of a series of 30-day courses to be given on the campus by the Extension Division to selected groups of veterans and lumber industry employees. The first group of 35 men will start on April 21, and finish on May 16, 1947. The aim is to attract intelligent and determined young men into the industry and give them a good running start. Details may be obtained from Lumber and Supply Dealers Council of Georgia, P.O. Box 2213, Atlanta, 1, Ga.

RENSSELAER POLYTECHNIC INSTITUTE'S tuition, beginning next September, will be increased from $500 to $600 a year. President Livingston W. Houston stated that the rise was necessary because maintenance costs have increased by 70 percent since 1941 and because "we must be in a position to raise faculty salaries to meet competition from industry." He also pointed out that R.P.I.'s income from endowment funds has decreased because of lower interest rates, and that the increase of more than 250 percent in student enrollment has further decreased endowment income per student.

"Nearly every college in the country is faced with a similar financial problem and a number of large universities have announced tuition increases," he said. However, no student will be forced to leave because of the increase. Deferred tuition notes and loans will be granted to those unable to meet the increase and the number of undergraduate scholarships will be increased. "According to most authorities," he concluded, "costs have reached a peak. Whenever costs decline enough to warrant it, our tuition rates will be adjusted downward."

A UNIQUE PROGRAM OF COURSES is to be given jointly by the Graduate Division of the College of Engineering of New York University and the Graduate School of Stevens Institute of Technology, which will combine instruction in the fields of aerodynamics, hydrodynamics and applied mechanics and which will make use of the experience, special teaching and experimental facilities of the two colleges. The one-year, full-time course will be known as "fluid dynamics of aircraft, ships, and related bodies" and will lead to a master's degree. It will open in September and enrollment will be limited to 15 students.

This course pioneers in combining in one plan of instruction the two closely related fields of hydrodynamics and aerodynamics, and is made possible by the experimental facilities of N.Y.U.'s Daniel Guggenheim School of Aeronautics and the Stevens Experimental Towing Tank Laboratory. The aerodynamic facilities of the former include two wind tunnels, one 4×4 ft and the other 7×10 ft and capable of wind speeds from 5 to 120 mph. Towing Tank facilities include three tanks—one 95 ft long and equipped with a wave-generating machine, a second 75 ft square for steering and turning tests, and a third 313 ft long and 12 ft wide primarily for seaplane model tests.

NINE NEW TAU BETA PI FELLOWS for 1947–1948 have been selected from a list of 105 applicants, all members of Tau Beta Pi. The nine men chosen to receive fellowships from this national honorary engineering association represent many of the leading engineering schools. The Tau Beta Pi Fellowships this year pay $1,000 to the two civilian recipients and $650 to six of the veterans, who also get full benefits under the G.I. Bill of Rights. One man, designated an Honorary Fellow, will receive no stipend because of other financial assistance. These nine awards bring to 91 the total fellowships granted since the program was inaugurated 17 years ago. The standing of this program is indicated by the fact that graduate schools customarily remit tuition fees for these Fellows. Yale, M.I.T., and California Institute of Technology have arranged to grant them tuition scholarships.

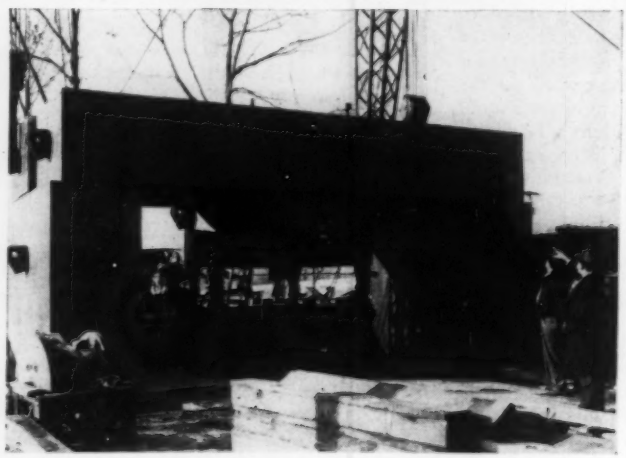
MUNICIPAL ENGINEERING ADMINISTRATION has been initiated as a new field of specialization at the University of Michigan. The new program, which will qualify students for the degree of Master of Science in Engineering, will require at least 30 hours of course work balanced between the Department of Civil Engineering and the Institute of Public Administration. Inquiries should be addressed to the office of Ralph A. Sawyer, dean of the Horace H. Rackham School of Graduate Studies, University of Michigan, Ann Arbor, Mich.

TEN GRADUATE FELLOWSHIPS in Traffic Engineering, amounting to $1,400 each, are available from the Bureau of Highway Traffic of Yale University. They provide for a full academic year of graduate study beginning September 22, 1947; nine are made available through grants from the Automotive Safety Foundation and one through the American Transit Association.

These fellowships are open to men who have a degree in some branch of engineering from an accredited college. Preference will be given to those now employed in street and highway work who secure a leave of absence in order to return to their present employer.

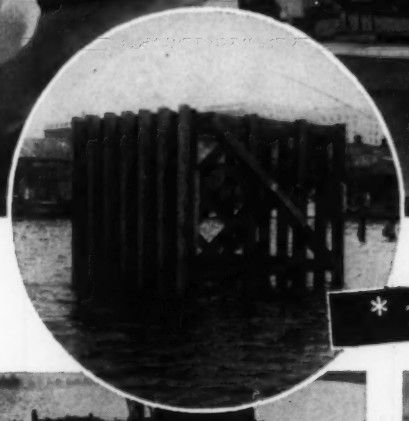
In addition to those who receive fellowships, the course is open to qualified veterans under the G.I. Bill of Rights. The closing date for applying for fellowships is June 15, 1947. Additional information may be obtained from the Bureau of Highway Traffic, Yale University, New Haven 11, Conn.

Second Largest Cyclotron Assembled



EIGHT SOLID STEEL FORGINGS, weighing average of 150 tons each, are assembled to form magnet of super cyclotron at University of Rochester. Cyclotron—second largest in U.S.—will produce particles of more than 200,000,000 electron volts. Eight full heats of open-hearth steel were cast by U.S. Steel's Carnegie-Illinois Steel Corp., Pittsburgh, Pa., in construction of magnet, for U.S. Navy's radiation program at the University.

* Why you can't always get ALL the construction steels you need just when you need them!



DESPITE the fact that our great mills are running at capacity—making more construction steel products than ever before—today's tremendous demand exceeds output. Supplying an industry that has waited five years for materials, taxes the production facilities of even the world's biggest mills.

That's the situation. We're doing our best to meet it impartially. But we need your cooperation.

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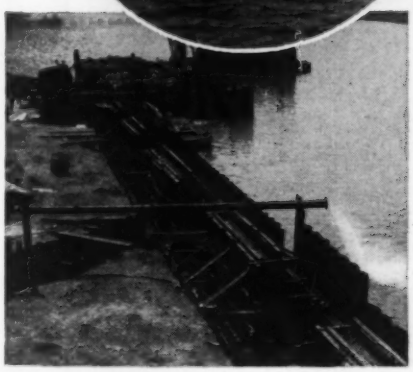
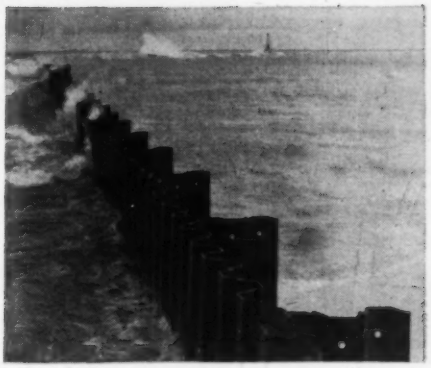
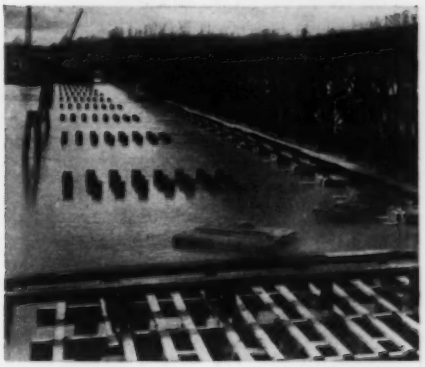
** The Demand for U·S·S Construction Products for jobs like these is greater than ever!*







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New Publications

Steel Tubular Products. To give producers and users of iron and steel products the benefit of a common and exact terminology, the American Iron and Steel Institute has been making a study and classification of terms. The results of the study are being presented in various sections of a Steel Products Manual. Section 18, entitled *Steel Tubular Products*, is now available and may be obtained at a cost of 25 cents postpaid from the American Iron and Steel Institute, 350 Fifth Avenue, New York, N.Y.

Traffic Safety. A guidebook for state and civic officials, entitled *Traffic Safety Education*, has been published by the Eno Foundation for Highway Traffic Control. Showing the relationship that should exist between engineering, enforcement, and educational activities in the community, the 68-page booklet will be helpful to municipalities in organizing and carrying out safety campaigns. The publication may be obtained from the Eno Foundation at Saugatuck, Conn.

Collective Bargaining. As a contribution to the development of sound management-labor relations, the Research and Policy Committee of the Committee for Economic Development has issued a statement on national policy, entitled *Collective Bargaining: How to Make It More Effective.* Single copies may be obtained without cost from the Committee on Economic Development, 285 Madison Avenue, New York 17, N.Y. Additional copies up to ten will be 25 cents apiece, and copies in bulk 18 cents apiece.

Malaria Control. Sanitary engineers will be interested in articles on malaria control by A. A. Weathersbee and Nelson H. Rector in the December 1946 issue of *The Journal of the National Malaria Society.* Subscriptions to this quarterly publication should be sent to M. D. Young, P.O. Box 1344, Columbia, S.C. Domestic subscriptions are $3 a year, and foreign $3.50.

Steel Industry. An address on "Iron Ore and the Steel Industry"—delivered by C. M. White, president of the Republic Steel Corp., before the 75th anniversary of the American Institute of Mining and Metallurgical Engineers—has been published in attractive booklet form. A limited supply is available without cost upon application to the AIMME, 29 West 39th Street, New York 18, N.Y.

Transportation. Believing that no phase of modern highway transportation is more important than vehicular parking, the Eno Foundation for Highway Traffic Control has issued a revised edition of its 1942 report on *Parking.* Inquiries should be addressed to the Eno Foundation, Saugatuck, Conn.

Ohio Surface Waters. To aid industries and municipalities in determining the suitability of surface water supplies, the Ohio Water Resources Board has issued Bulletin No. 4, entitled "The Industrial Utility of the Surface Waters of Ohio." The bulletin, which was prepared in cooperation with the U.S. Geological Survey, may be purchased from the Ohio Water Resources Board, Columbus, Ohio, at a cost of $1 a copy.

Zoning. A 278-page guide to the preparation of zoning ordinances has been issued by the New York State Department of Commerce under the title of *Zoning in New York State.* The guide was prepared by Joseph C. Federick, engineer consultant to the Department of Commerce. Inquiries should be addressed to the State of New York Department of Commerce, Albany, N.Y.

Engineering Education. An interesting booklet on "The Engineering Teacher, Keystone of the Profession," is available upon application to the author, Louis H. Berger, M. ASCE, president of C. L. Berger & Sons, Inc., 37 Williams Street, Boston 19, Mass.

Leadership. An address on "Principles of Leadership"—delivered by Col. John Hill Carruth, M. ASCE, before engineer troops of the Second Army in 1942, and published in *The Military Engineer*—has been issued in booklet form. Copies may be obtained from Colonel Carruth, P.O. Box 66, Grayson Street Station, San Antonio, Tex., at a cost of 50 cents a copy for quantities up to 100. For larger quantities, the price is less.

Water Power. An inventory of the water-power resources of Canada, conducted by the Dominion Water and Power Bureau, is available in mimeograph form upon application to the Bureau, Department of Mines and Resources, Ottawa, Canada.

Surveys. A set of Technical Standards for Property Surveys, adopted by the American Congress on Surveying and Mapping, has been reprinted from *Surveying and Mapping* and issued in booklet form. Inquiries should be addressed to the Acting Secretary, American Congress on Surveying and Mapping, Box 470, Benjamin Franklin Station, Washington 4, D.C.

Engineering Writing. The essential skills required in the preparation of engineering reports have been outlined by Frank Kerekes and Robley Winfrey, Members ASCE, in a 120-page mimeographed volume, entitled "Supplementary Notes for Engineering Reports." Both authors are on the engineering staff at Iowa State College, and the notes were prepared to assist students in the achievement of the essential skills through written, oral, graphic, and mathematical expression.

Oldest Engineering Society Elects Officers for 1947

THE BOSTON SOCIETY OF CIVIL ENGINEERS, which will be the first American engineering society to celebrate its centennial, held its 99th annual meeting on March 19. The following officers, many of them members of ASCE, were elected and installed:

President, Harvey B. Kinnison, M. ASCE; vice-president, Frederic N. Weaver, Assoc. M. ASCE; vice-president Everett N. Hutchins; secretary, Edwin B. Cobb; and treasurer, Chester J. Ginder. Directors elected were: Frank L. Flood, M. ASCE; Donald W. Taylor, Assoc. M. ASCE; George W. Coffin; and Herman G. Protze, Assoc. M. ASCE.

NEWS OF Engineers

Gano Dunn and **D. B. Steinman** will receive the honorary degree of doctor of science from the college of the City of New York on May 7. Since 1913 Dr. Dunn has been president of the J. G. White Engineering Corp., New York City. He is the author of numerous works on electrical and engineering subjects, and is the recipient of various honors, including the Edison Medal, the Hoover Medal, and the Egleston Medal of Columbia University. At present he is a trustee of Cooper Union. An author-

Pach Brothers

Gano Dunn D. B. Steinman

ity on the design and building of bridges, Dr. Steinman is a member of the New York consulting firm of Robinson & Steinman. He is the author of many books and papers on the theory and practice of bridge building, and has won the Society's J. James R. Croes Medal, the Thomas Fitch Rowland Prize, and the Norman Medal for technical papers. They are among several alumni being honored by the college on Charter Day, the culminating event of its centennial year.

Robert S. Holmes has been appointed to the newly created position of executive secretary to the Institute of Traffic Engineers, New Haven, Conn. Since his separation from the service Mr. Holmes has held a Civil Service appointment as the assistant to the War Department Safety Director, being responsible for the policy, administration, and supervision of all traffic engineering and safety activities connected with the Army Safety Program.

Malcolm Pirnie, Past-President of the ASCE and New York City consultant, has been elected to the Board of Trustees of Robert College, Istanbul, Turkey. Robert College introduced American engineering instruction to Turkey and the Near East in 1912 when it opened an engineering school.

Kenneth K. King has resigned as director of public works of Kansas City, Mo., to become general manager for the Kansas City contracting firm of C. S. Foreman Co.

George W. Barton is now with Associated Consultants, of Evanston, Ill., engaged in street traffic and transportation consulting work. He was formerly director of safety and traffic engineering for the Chicago Motor Club.

Washington's 2,000,000-gal. HORTON Elevated Tank serves a *Dual Purpose*

● The Horton elevated tank shown below was erected primarily to provide gravity pressure and a reserve in storage, independent of direct pumping, in a rapidly expanding area. The tank also prevents the area which it serves from drawing too heavily, during peak demand periods, on the area adjacent to it. Thus, the tank is used to improve the water service in two areas.

The fluted central column is a new feature in elevated tank design. This member, 40 ft. in diam., is not filled with water. A 5-ft. diam. riser inside of the column provides the connection between the tank and the distribution system. The tank itself is spheroidal shaped and is 106 ft. in diam. It has sixteen 4-ft. diam. outer columns. The structure is 49 ft. to bottom and has a range in head of 34 ft. 6 in.

When considering water storage facilities for municipal water distribution systems write our nearest office for quotations on Horton welded elevated tanks. Please state capacity required and height to bottom.

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A. F. Garlinghouse of South Pasadena, Calif., has been elected executive vice-president for 1947 of the Associated Equipment Distributors, international trade association for the construction equipment industry. For several years a leader in the association's activities in southern California, Mr. Garlinghouse recently served as chairman of its Committee on Employment of Discharged Veterans. He is general manager of Garlinghouse Brothers, a Los Angeles construction equipment firm.

A. F. Garlinghouse

Edward M. Beardslee, who has been engaged in city management work in Florida since 1942, has returned to active engineering practice as office engineer for the Atlanta Ga., firm of Shutze and Armistead. He has been city manager of DeLand, Fernandina, and Jacksonville Beach, Fla.

Lewis A. Dickerson and **George D. Whitmore** have been added to the advisory committee of the photogrammetry department of Syracuse University. The former is chief of the Photogrammetry Division of the Army Map Service, and the latter chief of the Research and Technical Control Division of the U.S. Geological Survey.

Paul L. Nichols is now associate civil engineer for the East Bay Municipal Utility District, with headquarters at Oakland, Calif.

Frederick T. Thorpe, Jr., has been promoted to the position of assistant chief engineer and surveyor in the Bureau of Engineering, Surveys and Zoning, Department of Public Works, Philadelphia, Pa. Mr. Thorpe was previously surveyor and regulator in one of the city's survey districts.

George E. Shepherd has been transferred from the Jacksonville, Fla., District of the Corps of Engineers, to the Tulsa, Okla., District, and is now assigned as resident engineer at the Fort Sill Project Office, Fort Sill, Okla.

Charles W. Sherman, Life Member of the ASCE, has been elected an honorary member of the Boston Society of Civil Engineers. Mr. Sherman has been active in the affairs of the Boston Society of Civil Engineers since 1898 and has served as its treasurer for five years and as vice-president for two years. Until his retirement in 1941, he was a member of the Boston firm of Metcalf & Eddy.

Robert H. Nagel, editor of *The Bent*, quarterly publication of Tau Beta Pi, has been appointed to a full-time position as secretary-treasurer-editor of the association. Mr. Nagel recently resigned as assistant bridge engineer for the Southern Railway to devote all his time to Tau Beta Pi. He has been editor of *The Bent* since 1942.

Ray Warren, who was recently released from the Army Corps of Engineers with the rank of lieutenant colonel, has established a consulting practice at 206 Library Place, Greensboro, N.C. Mr. Warren was formerly city engineer at Greensboro, N.C., and executive director of the Greensboro Housing Authority.

Ellis Wing Taylor, formerly a member of the Los Angeles structural engineering and architectural firm of Edward Cray Taylor & Ellis Wing Taylor, will continue his practice in that city with an executive staff consisting of **Clarence S. Stacy, Roy B. Parkes, Donald R. Wilkinson, Richard F. Hollman, Leonard M. Clausen,** and **Melford B. Harrison.**

Robert J. Poss is now superintendent of maintenance, construction and purchasing for the city of Marinette, Wis. He was previously city engineer of Algoma, Wis.

Harry A. Gerard was recently appointed airport engineer of the Civil Aeronautics Administration for Kentucky. He was formerly district airport engineer for the Administration at Prescott, Ariz.

Charles B. Ferris, vice-president of the Gramatan National Bank, Bronxville, N.Y., and a former colonel in the Army Corps of Engineers, has been put in command of the 410th Engineer Special Brigade, Organized Reserve, New York City. During the war, Colonel Ferris saw combat duty with the 27th Infantry Division in the landings at Makin and Saipan, and later served as assistant chief of staff, Headquarters, South Pacific Base Command.

Robert G. Dyktor is now office engineer in the marketing department of the Creole Petroleum Corp., at Caracas, Venezuela. He was formerly junior engineer at Caracas for the New York consulting firm of Parsons, Brinckerhoff, Hogan & Macdonald.

F. J. C. Dresser, consulting engineer for the Mutual Life Insurance Company of New York, recently received a Presidential Certificate of Merit for "outstanding fidelity and meritorious conduct" during World War II. At a special ceremony held in conjunction with Army Week, April 6–12, the presentation was made by Gen. Courtney H. Hodges to Colonel Dresser for his aid in the war effort as a member of the Quartermaster General's Construction Advisory Board.

GEN. COURTNEY H. HODGES AWARDS
Certificate of Merit to Col. F. J. C. Dresser

Richard Gallagher has been engaged in private practice as a traffic engineer and traffic planner since his release from the Civil Engineer Corps of the Navy in the fall of 1945, with the rank of lieutenant commander. His office is in Ventura, Calif. Prior to the war, Mr. Gallagher was in the traffic engineering department of the California Division of Highways.

Samuel N. Karrick, colonel, Army Corps of Engineers, has been appointed district engineer of the San Francisco district. During the war, Colonel Karrick served in the Southwest Pacific for almost three years, and after the capture of Manila commanded the Manila Engineer District and the Engineer troops charged with Army construction in the Philippines. Prior to the war, he was district engineer of the Chicago district, where he was responsible for river and harbor improvements on the Great Lakes and for the building of the locks and dams on the Illinois River.

S. N. Karrick

Robert Ferguson Legget was recently appointed director of the newly created division of building research of the Canadian National Research Council, with headquarters at Ottawa, Canada. The new division will provide the scientific data for a complete construction program, including building materials, types of construction, and layout. Until lately Professor Legget was assistant professor of civil engineering at the University of Toronto.

Samuel Valenstein has opened an office under the firm name of S. Valenstein & Associates at 152 West 44th Street, New York City. Mr. Valenstein formerly was project engineer for M. Shapiro & Son Construction Co., New York contractors and engineers. In connection with a general structural design practice, the new firm specializes in the design of continuous-span steel and concrete bridges.

Leon A. Hostetter has resigned as senior engineer in the U.S. Engineer Office at Sacramento, Calif., to go to Teheran, Iran, where he will work for the Iranian government in surveying the irrigation and flood-control needs of that country.

Watson J. Grumm is leaving the United States for an assignment in Arabia with the Standard Oil Co.

Willard M. Snyder has accepted a position with the U. S. Bureau of Reclamation at Billings, Mont. During the war, Mr. Snyder was in the Navy.

Simeon G. Toribio has been elected to the House of Representatives of the Congress of the Philippines, Manila, P.I. Mr. Toribio writes, "The electorate of my district voted for me in the firm belief that an engineer should be an important member of our Philippine Congress during this time of reconstruction and rehabilitation. . . . Of the 98 members of our Lower House, three are civil engineers and one a mining engineer."

John V. Spielman was recently appointed supervisor of dams, Division of Water Resources, California State Department of Public Works, for Southern California, with headquarters in Los Angeles.

Calvin N. Joyner, secretary of commerce in the military government of Korea under Gen. John B. Hodge, has been awarded the Medal of Merit. He was cited for his serv-

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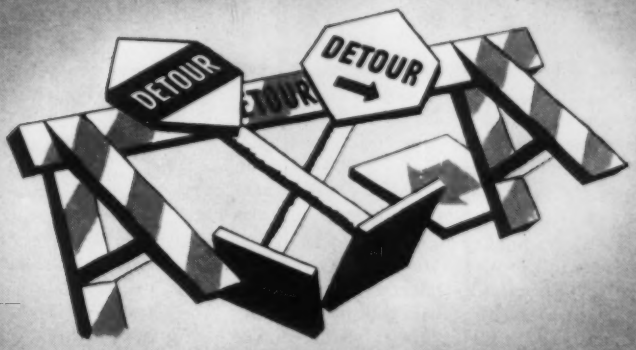

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That's just one of the many advantages you get. And so does the motoring public you serve. Other advantages that only asphalt resurfacing gives include: Speed in laying the job—the economy of using local aggregates and local labor—all-weather, easily maintained surface.

Before you invest in road rebuilding, investigate asphalt. It may help you make your highway dollars go farther. When planning

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ices in China between 1943 and 1945 when he was special representative of the Foreign Economic Administration and head of America's lend lease commission to China. Mr. Joyner was recently in Washington, where the presentation was made by Secretary of War Patterson.

D. B. Gumensky has resigned as senior engineer in the Water Resources Division of the U.S. Engineer Office at Sacramento, Calif., to accept the position of principal design engineer in the hydroelectric division of the National Resources Commission of the Chinese Government. His headquarters will be at Nanking.

Ben Balala, until lately assistant bridge engineer in the California State Bridge Department, has joined the staff of Jesse E. Hayes, structural engineer of San Francisco.

Charles E. Hughes, Jr., is now sanitary engineer for the Decatur, Ill., consulting firm of Warren & Van Praag, Inc. During the war he was in the Sanitary Corps of the Army.

Frederick H. Dechant, consulting engineer of Philadelphia, Pa., has been appointed advisory engineer in the Pennsylvania Department of Forests and Waters, in which capacity he will direct the state's project of cleaning up the Schuylkill River.

Carl A. Trexel, rear admiral, Navy Civil Engineer Corps, has been transferred from Seattle, Wash., to San Francisco, where he will be head of the Pacific division of the Navy's Bureau of Yards and Docks. In Seattle, Admiral Trexel was superintending civil engineer of the 13th Naval District.

Paul D. Haney, for the past five years chief engineer of the division of sanitation of the Kansas State Board of Health, has accepted the position of associate professor of sanitary engineering at the University of North Carolina.

C. H. Mottier, vice-president and chief engineer of the Illinois Central System, has been elected first vice-president of the American Railway Engineering Association, and F. S. Schwinn, assistant chief engineer of the Missouri Pacific Lines, has been elected second vice-president. Two other members of the ASCE—**T. A. Blair,** assistant chief engineer of the Atchison, Topeka & Santa Fe Railway, and **H. S. Loeffler,** assistant chief engineer of the Great Northern Railway—have been elected directors.

Albert A. Mittag has resigned as chief engineer of the Panama Engineering Division to accept the position of general superintendent of construction for the South American firm of Constructora Martinz.

James Gould—with **Otto W. Knutson** and **C. A. Knutson**—has established the Knutson-Gould Construction Co., at Kansas City, Mo. The firm will operate a general contracting business.

Allen R. Wilson of Lansdowne, Pa., has retired from the Pennsylvania Railroad after many years of service. For the past twenty years he has been engineer of bridges and buildings at Philadelphia.

Frederic D. Foss—with **Harry R. Halloran** and **Fred W. Narr**—has formed the general contracting firm of Foss-Halloran-Narr, Inc., in Long Island City, N.Y. The firm will specialize in foundations and structural concrete work in the New York area. Mr. Foss was formerly with the Corbetta Construction Co., of New York.

Martin A. Mason, principal engineer for the Beach Erosion Board, Washington, D.C., is the recipient of the 1946 award of the Washington Academy of Sciences in engineering science. He was cited for "his distinguished service in erosion studies leading to successful invasions on Japanese beaches by our armed forces."

B. J. Fry and **E. E. Norwood** were recently elected vice-presidents of the E. J. Albrecht Co., Chicago engineering and contracting firm. Mr. Fry was previously chief engineer, and Mr. Norwood project engineer of the firm.

Konstantine L. Kollar, until lately sanitary engineer in the Bureau of Yards and Docks, has accepted an engineering position with the Health and Sanitation Division of the Institute of Inter-American Affairs, with headquarters in Washington, D.C.

Deceased

Charles Dwight Avery (M. '17) senior geologist for the U.S. Geological Survey, Washington, D.C., died on February 1, at the age of 69. Mr. Avery was in the General Land Office of the Department of the Interior at Helena, Mont., and Cheyenne, Wyo., from 1908 to 1920, and with the U.S. Geological Survey in Washington from the latter date on. Long active in the Society, Mr. Avery served as president of the District of Columbia Section in 1927 and 1928. He had also served on the Society's Committee on Salaries.

Henry Florentine Blood (M '23) consulting engineer of Portland, Ore., died in that city on January 20. Mr. Blood, who was 63, had maintained a consulting practice in Portland for many years. Projects on which he served as consultant included the fishways at Bonneville Dam and numerous school and skyscraper structures in the Northwest. During the war, he was connected with Timber Structures, Inc.

Royall Douglas Bradbury (Assoc. M. '12) since 1945 in the department of design of the Public Roads Administration, Washington, D.C, died in that city on March 21. Mr. Bradbury, who was 64, was engineer-director of the Wire Reinforcement Institute in Washington from 1930 to 1945. Earlier he had been contracting manager of the Aberthaw Co., Boston, Mass., and president of the George H. Adams Co., of Waltham, Mass.

Samuel Jefferson Chapleau (M. '05) retired engineer of Ottawa, Canada, died on February 25, at the age of 78. Born and educated in the United States, Mr. Chapleau was engaged in railroad work and on the construction of the New York State Barge Canal here before going to Canada. From 1901 until his retirement in 1938, he was in the Department of Public Works of Canada, at Ottawa, serving successively as assistant engineer, principal assistant engineer, senior engineer, and consultant to the Department.

John Rose Wilson Davis (M. '03) retired chief engineer of the Great Northern Railway, Seattle, Wash., died on February 19. Mr. Davis, who was 78, had spent his whole career in railroad work. He became connected with the Great Northern in 1903, and from 1925 until his retirement in 1940 was chief engineer, with headquarters in St. Paul, Minn. He was in charge of constructing the railroad's eight-mile Cascade Tunnel, which was completed in 1929.

J. R. W. Davis

John Stephen Doyle (M. '10) consultant to the U.S. Engineer Department at Baltimore, Md., died in Florida on March 11. Colonel Doyle, who was 73, spent much of his career in the Baltimore District of the U.S. Engineer Department. Beginning in 1910, he was successively principal assistant engineer, district engineer, and principal engineer. Since 1943 he had served as consultant to the Department. During the first World War, Colonel Doyle was an Engineer officer in the River and Harbor Section of the Office of the Chief of Engineers.

John Conrad Fitterer (M. '24) head of the mathematics department at the Colorado School of Mines, Golden, Colo., died recently. He was 75. From 1903 to 1908 Professor Fitterer was engaged on various projects for the U.S. Reclamation Service (now the Bureau of Reclamation), and from 1908 to 1928 was professor of civil engineering at the University of Wyoming. In the latter year he became professor of mathematics at the Colorado School of Mines. Professor Fitterer was the author of several books on reclamation and meteorological subjects.

Adriano Gonzalez (Affiliate '26) president of the Caribbean Engineering Co., San Juan, Puerto Rico, died on March 13. He was 70. Mr. Gonzalez had been in charge of the construction of water works, highways, and public utilities for the Puerto Rican government and, in partnership with Rivera Ferrer, constructed an aqueduct and dam for Santo Domingo and public works for the Dominican Republic. Since 1935 he had been president of the Caribbean Engineering Co. Mr. Gonzalez was active in the Puerto Rico Section of the Society and served as President in 1942.

Julius Reed Hall (M. '16) consulting engineer of Oak Park, Ill., died in a hospital there on March 26, at the age of 66. Mr. Hall had been designing engineer for the Strauss Bascule Bridge Co.; principal assistant engineer for the Chicago Sanitary District; and general superintendent of construction for the Century of Progress exposition. More recently he had been consulting engineer for the PWA. During the first World War, Mr. Hall served as a captain with the 515th Engineers overseas.

Herbrand Harvey (M. '13) of Fulwood House, near Petersfield, Hants, England, died there on February 22. Mr. Harvey, who was 74, was a specialist in the construc-

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tion of the Para Harbor Works at Para, Brazil; port works and a cable station on Guam; and a 15,000-ton plant extension for the Chile Copper Co., at Chuquicamata, Chile. He was also resident engineer on the construction of the 80,000-ft Lochaber water power tunnel at Fort William, Scotland.

George Willis Hutchinson (Assoc. M. '42) engineer of Raleigh, N.C., died suddenly there on March 10, at the age of 54. Mr. Hutchinson was the first head of the North Carolina State Highway Department's division of tests, and for a number of years was materials engineer for the Department. He had also been concrete technician for the Appalachian Electric Power Co., at Roanoke, Va.; technical representative for the Gray Concrete Pipe Co., at Thomasville, N.C.; and concrete consultant to the Mason & Hanger Co., on the construction of the Radford, Va., plant of the Hercules Powder Co. During the first World War, Mr. Hutchinson was an officer in the Air Corps.

Edmund Irving Mitchell (Assoc. M. '21) of Upper Montclair, N.J., died on February 19, at the age of 57. Mr. Mitchell had been resident engineer on various water-works and sewerage projects in New York and New Jersey, and assistant state engineer inspector for New Jersey. More recently he was traveling engineer for the PWA, and with the Interstate Sanitation Commission in New York City.

De Witt Pawling Pugh (M. '08) of Wayne, Pa., died there on February 27, at the age of 74. Mr. Pugh was a civil engineer for the Pennsylvania Railroad for 48 years, specializing in the reconnaissance, location, and construction of railroads and highways. He retired in 1943.

James Lawrence Tighe (M. '04) consulting engineer of Holyoke, Mass., and head of the Holyoke Gas and Electric Commission, died on April 6, at the age of 82. Born in Ireland, Mr. Tighe was educated in the United States and Canada. In his early career, he worked under the late J. Waldo Smith, Hon. M. ASCE, and the late Clemens Herschel, Past-President ASCE. Mr. Tighe was water department engineer of Holyoke from 1892 to 1911, and city engineer from 1899 to 1911. Since then he had been in practice in Holyoke as a consulting hydraulic and sanitary engineer—in later years as head of the firm of Tighe & Bond.

Benjamin Franklin Williams (M. '28) liaison engineer for the Texas State Health Department, Austin, Tex., died there on March 7. He was 72. For a number of years Mr. Williams was county surveyor and district engineer of Kaufman County, Texas, and from 1925 to 1931 he was state reclamation engineer. He had also served as consultant to the International Water Commission on flood control on the Lower Rio Grande; to the City and County of Dallas on the design of flood control; and on the Orange, Tex., Reclamation Project. As project engineer for the PWA, he designed works for the Willacy County Water Control and Improvement District.

Los Angeles Area Needs Adequate Parkway System

(*Continued from page 31*)

at a rate in any way commensurate with the need.

Plans are being prepared for the Sepulveda Parkway from Ventura Boulevard to Venice Boulevard, a distance of 11.0 miles. Sufficient funds are available to protect the right-of-way against any large proposed developments. Plans are also being prepared for the Inglewood Parkway, an important route from downtown Los Angeles, via the Harbor Parkway and Los Angeles Airport. Preliminary planning is under way on several other routes which are considered to be of early priority.

Standards of Design

American Association of State Highway Officials Interstate Highway Standards are being followed closely in the design of parkways in this area. Where possible, we are using the even higher requirements of the Federal Interregional Highway Standards. However, attention is called to certain things that our experience with the parkways already constructed has shown us.

Shoulders along the right-hand lane of the parkway roadways are extremely important for safety and for the maintenance of traffic capacity. To this end, all parkways are now being planned with 8- to 10-ft sodded shoulders, separated from the main paved roadway by a low rolled curb. This makes possible the ready use of the shoulders in emergency but discourages their use as a possible extra traffic lane in time of heavy traffic. Generous horizontal curvatures are indicated as being very desirable to keep traffic in lanes. A minimum radius of 2,000 ft is being maintained except for unusual circumstances. By using traffic lanes of 12-ft width, it is not considered necessary to spiral curves that are of this radius or greater.

Each parkway intersection, and in fact each point of ingress or egress, is found to be an individual problem and no standardized design can be devised that will fit into all of them. Various intersection, interchange, and other design features are shown in accompanying illustrations.

Parkways are so named because they are planted and landscaped within the right-of-way boundaries, to give the effect of an elongated park. From the very start of the development of parkways in this area, it has been a primary consideration that these thoroughfares should be more than just traffic carriers. It was believed that their location would have a marked effect on the future development and zoning of the area, and that the parkways would tend more than any other one factor to fix and stabilize values in the various districts through which they pass.

New Construction Technique Reduces N.Y. Housing Cost

(*Continued from page 36*)

hasn't someone evolved a plastic floor covering? We have 230 acres of floors to build. Why hasn't someone brought out an economical prefabricated partition to eliminate the time lost by the present archaic method of plastering? The writer has seen practically all the proponents of new types of partitions—but again the payoff is in what they cost. So far, none is less costly than our 2-in. plaster partition. Why hasn't someone improved on the present method of exterior wall construction? Here again, the writer has purposely listened to everyone who came to his door with a new type of wall construction—in the hope that someone, sometime, would come in with the answer. Cavity wall construction at Elliott Houses—shown in an accompanying photograph—is an example of what can be done in this respect. Please notice again that the emphasis is on those phases of the building that have to do with areas.

As to prefabrication, there has been a great deal of misunderstanding about this term as applied to large-scale housing, primarily because it has been associated popularly with the delivery to a site of a completely fabricated dwelling unit. In the true sense of the word, there should be a constantly increasing field for prefabrication in work such as ours.

Fire Precautions Inconsistent

An inconsistency that has puzzled the writer is that a fireproof building embodies all precautions against combustion—in the materials and forms of construction used. A non-fireproof structure does not, and in principle therefore should require more safeguards. Fundamentally, the enclosure walls of the fireproof building are there to provide adequate insulation and protection against the elements. Yet in New York City and many other cities exterior walls of the fireproof building must have a higher fire-resistive rat-

200,000-gal. tank in two 100,000-gal. sections, with 200,000-gal. standpipe at base, for fire protection at large assembly plant.

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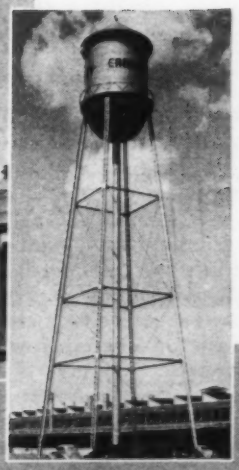
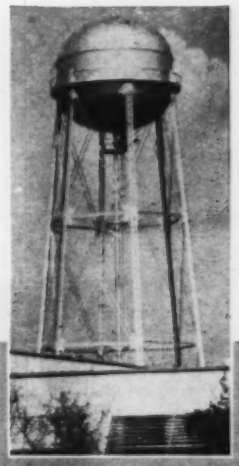
Seattle, 578 First Avenue, South

200,000-gal. Double Ellipsoidal Tank on 125 ft. tower. Columbia Steel Co.



Hemispherical bottom 100,000-gal. tank on 116 ft. tower. Crosley Radio Corporation.

Hemi-ellipsoidal bottom 100,000-gal. tank on 44 ft. tower. El Paso Natural Gas Co.



Double ellipsoidal 130,000-gal. tank on 100 ft. tower. Walt Disney Studios.

ing than those of the non-fireproof building. How can improvements in wall construction develop with inconsistencies and penalties like these?

1948 Construction Costs

Prior to the war, we were building fireproof buildings for less than 40 cents per cu ft. It had been a hard fight to accomplish that low cost and the writer has tried to show how we went at it. Economists show by charts and cost indices that current costs are maybe 50 to 60 percent higher than those of 1940. Their analyses, however, do not reflect a true picture. A cost index as usually prepared is based on posted material prices (which may or may not be realistic considering shortages and delays in deliveries) and on current wage scales (which do not reflect productive effort on the job as affected by shortages of labor or materials). The acid test of costs is in bidding and building. With nearly $65,000,000 of construction contracts bid during 1946 alone, an economist is not needed to determine current costs. Costs are already more than twice what they were in 1940. This is fact—not theory. With costs like these the need for economy is even more pressing.

Good Records Make Good Witnesses

(*Continued from page 39*)

with them, and how often a court must regretfully rule that the failure is fatal. It is unwise to take such chances. It is wiser to read your contract carefully and comply strictly with its terms, rather than to hope that your failure to do so may be cured in court by proof that the other party waived the requirement.

In addition to strict compliance with legal and contractual requirements to "put it in writing," there are other opportunities for making a good record as the job proceeds. Though not legally compulsory, they offer substantial assistance towards ultimate success in court, and, in a sense, they should be regarded as a form of insurance.

Letters May Be Vital Evidence

Accordingly, if you have a complaint to make, write a letter about it. If you reach an oral understanding with the other party, write him a letter of confirmation. If you receive a letter containing a serious misstatement of fact, don't just cuss and file it away. Answer it with a denial, or with a statement of the true facts as you see them. Otherwise a judge or jury may some day interpret your silence as an admission by you that the facts were as the other party stated them.

And since your letters may some day be vital evidence, keep this in mind when you write them. That doesn't mean that you need go as far as the Broadway playboy who, after losing a few breach-of-promise suits, addressed his letters to his next girl friend this way: "Dear Gladys and Gentlemen of the Jury." It does mean, however, that care should be taken to make your letters clear and accurate, with an ear sensitive to how they may sound if they ever have to be read in court.

It is imperative also that books and cost records, and job progress and other daily reports of foremen, superintendents and others, be accurate, complete, and meticulously maintained. These may be and often are necessary evidence, without which your side of the case may suffer a fatal blow.

The necessity of making a good record is pressing and often critical because every lawsuit is a contest designed primarily to determine the true facts in the case, or in other words: What really happened? Only secondary is the problem of what rule of law is to be applied to the facts; since that rule depends on which version of the facts is believed to be "true?" Let "A" represent the believed or proved facts and "B" the rule of law applicable to those facts, and the judicial process can be expressed in the form of an equation, thus: A × B = Decision.

Judge and Jury Must Be Convinced

It can readily be seen, therefore, that the ability to prove a fact to the satisfaction of a judge and jury is of the utmost importance. For the practical purposes of a litigation, a fact which cannot be so proved is no fact at all—no matter how theoretically true it may be. Here, again, it is not what actually happened that determines the outcome of the case; it is what the judge or jury *believes* happened that is legally significant.

And this must be so, since neither judge nor jury were physically present to watch the building go up or to sit in on conferences between the parties to a contract. Their knowledge of the facts must depend upon the evidence presented before them, and when that evidence, as frequently happens, is conflicting, the judge and jury are required to decide which version is the true one.

Judges and juries, being human, are subject to the same impulses, prejudices, and capacity for error as afflict the rest of the human race. These infirmities, however, inject a more serious factor of uncertainty as to the outcome of litigation when the truth must be sought in the conflicting oral testimony of witnesses rather than in the written record.

In this connection, it is appropriate to recall the words of a judge who long ago said in an opinion, "I would sooner trust the smallest slip of paper for truth than the strongest and most retentive memory ever bestowed on mortal man." And the wisdom of this judicial observation should command the constant and particular concern of the parties to a construction contract.

Design Constants Facilitate Analysis of Beams

(*Continued from page 43*)

is referred to by some writers as "the moment of dissymmetry." It may be defined as the summation of all the infinitesimal portions of the area, each multiplied by the cube of its distance from the point of reference. It is similar to the moment of inertia except for the power of the distance by which every infinitesimal part of the area is to be multiplied.

For a rectangular area, the value of j with respect to some point, p, is

$$j_p = (2\,i_g + i_p)z_p$$

where i_g and i_p are as indicated above, and z_p is the distance of the gravity axis of the area from point p.

As in the case of the moment of inertia, the total j of a given area with respect to any point is the sum of all the j's of the component parts of the area with respect to the same point, except that in this case, owing to the odd power involved, due regard must be given to the algebraic sign.

Derivation of the Above Formulas

The derivation of the above formulas is obtained from the simultaneous solution of the well-known elastic equations after the following substitutions in those equations:

$$\int \frac{dx}{I} = a; \quad \int \frac{x\,dx}{I} = m;$$

$$\int \frac{x^2\,dx}{I} = i; \quad \int \frac{x^3\,dx}{I} = j$$

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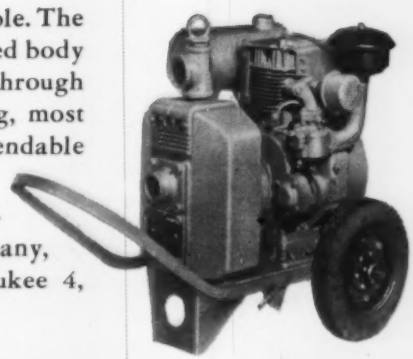

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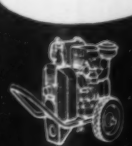
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APPLICATIONS FOR ADMISSION OR TRANSFER

May 1, 1947 — Number 5

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board. Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

APPLYING FOR MEMBER

ANDERSON, HAROLD ALBERT (Assoc. M.) (Age 39) Vice-Pres. and Dist. Mgr., The Austin Co., New York City.

ASHWORTH, IRVING FRANCIS (Assoc. M.) (Age 47) Director, Div. of Mapping and Zoning, Dept. of City Planning, New York City.

BHATT, UPENDRA JIVANRAM (Age 38) Chf. State Engr., PWD, Bhavnagar State, Bhavnagar, India.

BOHNER, ARTHUR WILLIAM (Age 48) Constr. Engr., Nebraska Dept. of Roads and Irrigation, Lincoln, Nebr.

BOSWELL, CLAY C. (Age 53) Chf. Engr. and Vice-Pres., Minnesota Water Light & Power Co., Duluth, Minn.; also Chf. Engr., Superior (Wis.) Light & Power Co.

BOWMAN, EUGENE CRONAN (Age 41) Chief of Inspection Branch, U.S. Engr. Office, Memphis, Tenn.

CASPER, FERDINAND EDWARD (Assoc. M.) (Age 46) City Engr., Orange, N.J.

CHINN, ARMSTRONG (Age 52) Pres., Terminal R.R. Association of St. Louis, Mo.

CONFORTI, JAMES, JR. (Age 31) Lt. Comdr. (CEC), USNR, New York City.

CUNNEY, GEORGE ALOYSIUS (Age 55) Gen. Engr. P-4, Bureau of Yards and Docks, Washington, D.C.

DOSHI, AMRITLAL GHELABHAI (Assoc. M.) (Age 43) State Engr., Gondal, India.

DUKE, CHARLES SUMNER (Age 68) Civ. and Constr. Engr., FWA, Sewer and Water Supply Project Review, Virgin Islands.

FAGO, VICTOR SIGFRID (Age 39) Constr. Engr., W. E. Kier Constr. Co., Los Angeles, Calif.

FOLLIN, JAMES WIGHTMAN (Assoc. M.) (Age 55) Asst. Administrator, FWA and Deputy Administrator, Office of Temporary Controls, Washington, D.C.

FRIERSON, ROBERT EDWARD (Assoc. M.) (Age 45) Head of Surveys System, TVA, Chattanooga, Tenn.

FRITZ, EDUARD, JR. (Age 48) Engr. of Transmission Design, Pennsylvania Water & Power Co., Baltimore, Md.

FULLER, RAYMOND HAROLD (Age 36) Member of firm, Burgess & Niple, Cons. Engrs., Columbus, Ohio.

GILMORE, ROBERT ALLEN (Age 41) Project Engr., J. E. Greiner Co., Cons. Engrs., Baltimore, Md.

GRAY, WALTER BARRY (Age 61) Chf. Struct. Engr., Holabird & Root, Architects, Chicago, Ill.

HAZEN, RICHARD (Assoc. M.) (Age 36) Partner, Malcolm Pirnie Engrs., New York City.

HETTELSATER, DITLEE RAEDER (Age 62) Jones-Hettelsater Constr. Co., Kansas City, Mo.

HOFFMAN, ORLANDO LEWIS (Age 47) Head, Eng. Planning Branch of Eng. Div., War Dept., Portland, Ore.

HORAN, HAROLD JOSEPH (Age 57) Asst. Chf. Engr., Sewers & Paving Sec., Dept. of Pres., Board of Public Service, St. Louis, Mo.

ISSAHAROW, HAY (Age 44), on new hydro-electric and irrigation works, Palestine Electric Corp., Ltd., Haifa, Palestine.

IVIE, WILLIAM BALFOUR (Age 46) Chief, Field Investigation Branch, Western Ocean Div., Corps of Engrs., Sausalito, Calif.

KNAPP, HERBERT TOLFREE (Age 55) Consultant to Chf. Engr., Greek Govt., Washington, D.C.

LARSEN, HERLUF THOMSEN (Assoc. M.) (Age 36) Major, Corps of Engrs., and Chief, Air Installations Div., Air Material Area, Tinker Field, Oklahoma City, Okla.

LARSON, HOWARD DREW (Jun.) (Age 35) Design Mgr., Civ. Engr. P-5, U.S. Navy, Treasure Island, San Francisco, Calif.

LATHAM, JAMES KEITH (Age 40) Member of firm, Howard K. Bell, Cons. Engrs., Lexington, Ky.

LOHR, ALBERT FLOYD (Age 61) Des. Engr., The Jennings-Lawrence Co., Columbus, Ohio.

LYNDE, EARL JOSEPH (Assoc. M.) (Age 56) Chief San. Engr., Pasadena, Calif.

MACDUFFIE, KARL MERRIEL (Assoc. M.) (Age 52) Senior Engr., Corps of Engrs., War Dept., Portland, Ore.

MACNISH, CHARLES FRASER (Assoc. M.) (Age 40), Prin. Engr., and Chf., Civ. Works Branch, Div. of Engrs., U.S. Engr. Dept., Kirkwood, Mo.

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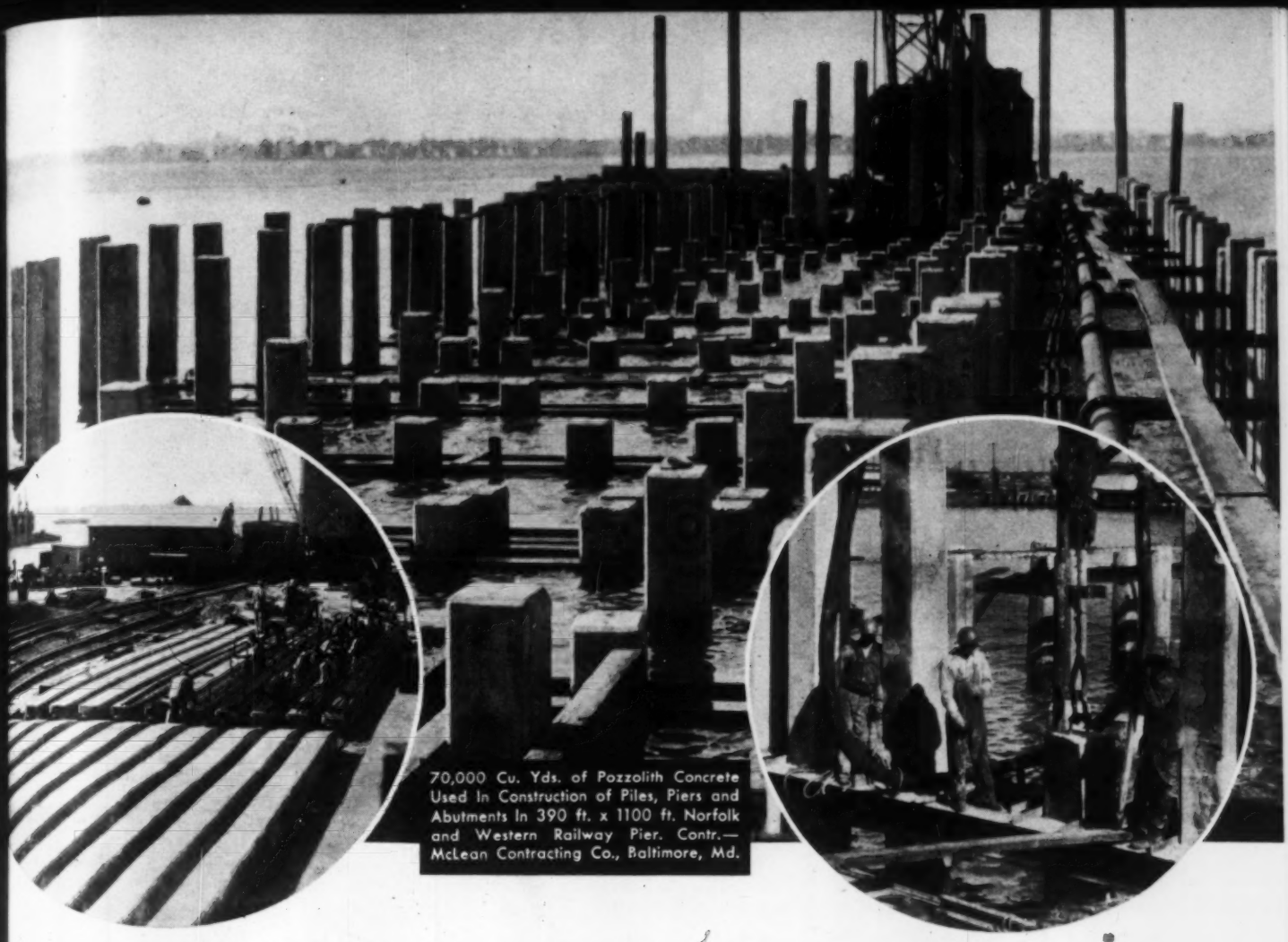

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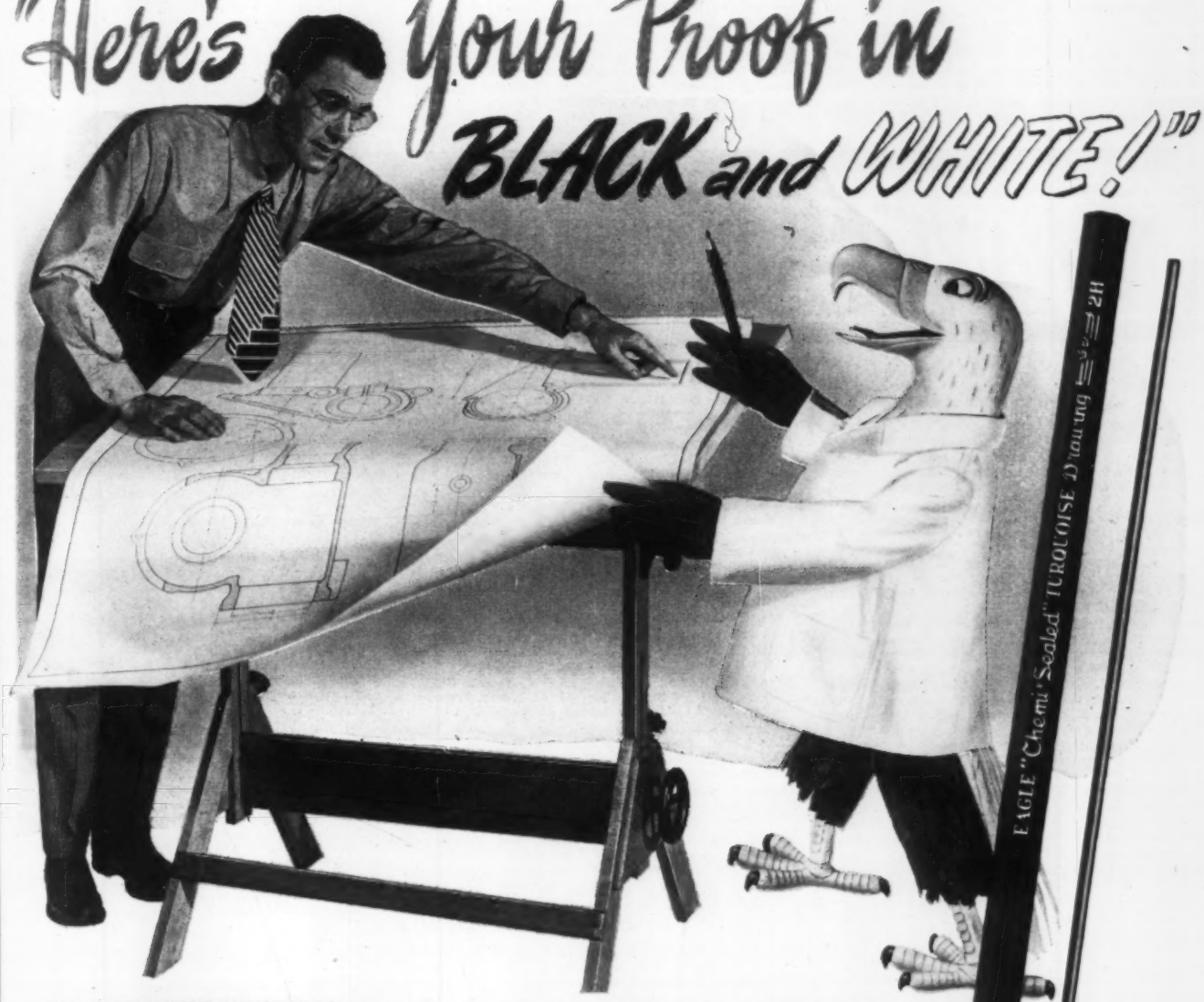

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From March 10 to April 9, 1947, Inclusive

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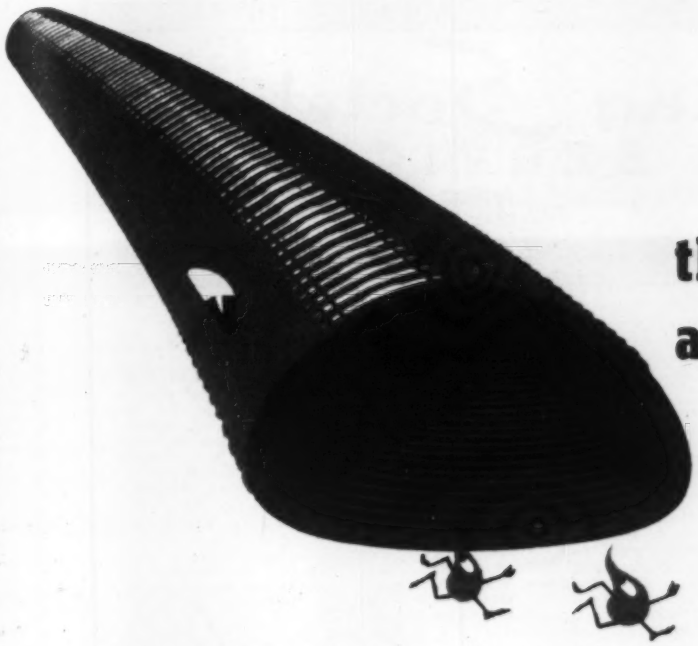
(*Continued on page 88*)



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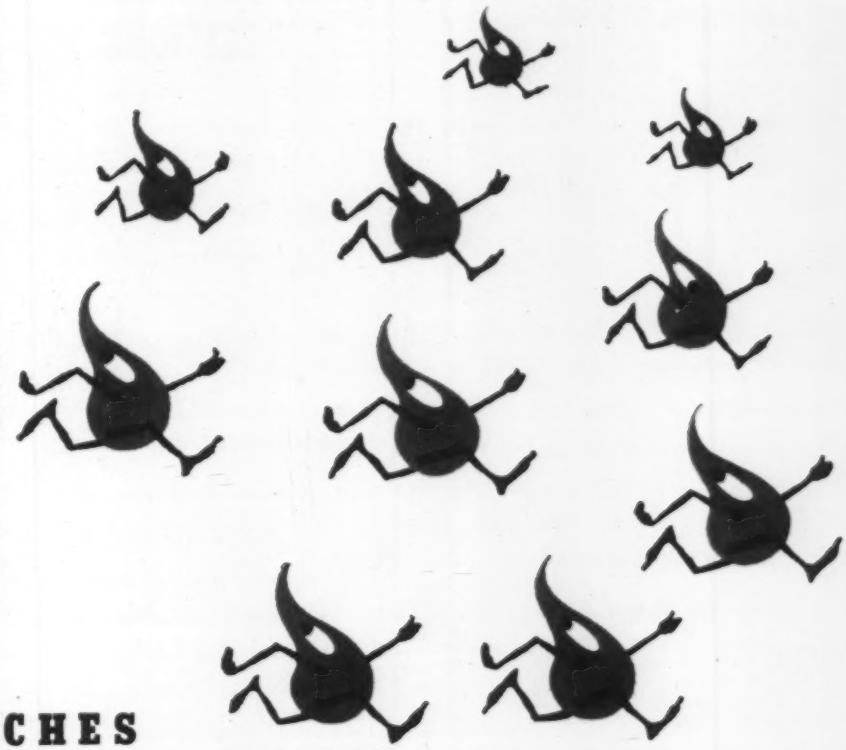

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(*Continued on page 86*)

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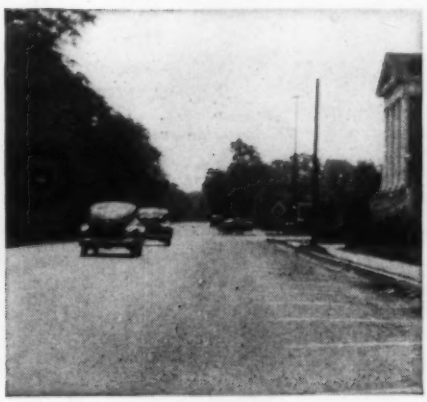

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(*Continued from page 84*)

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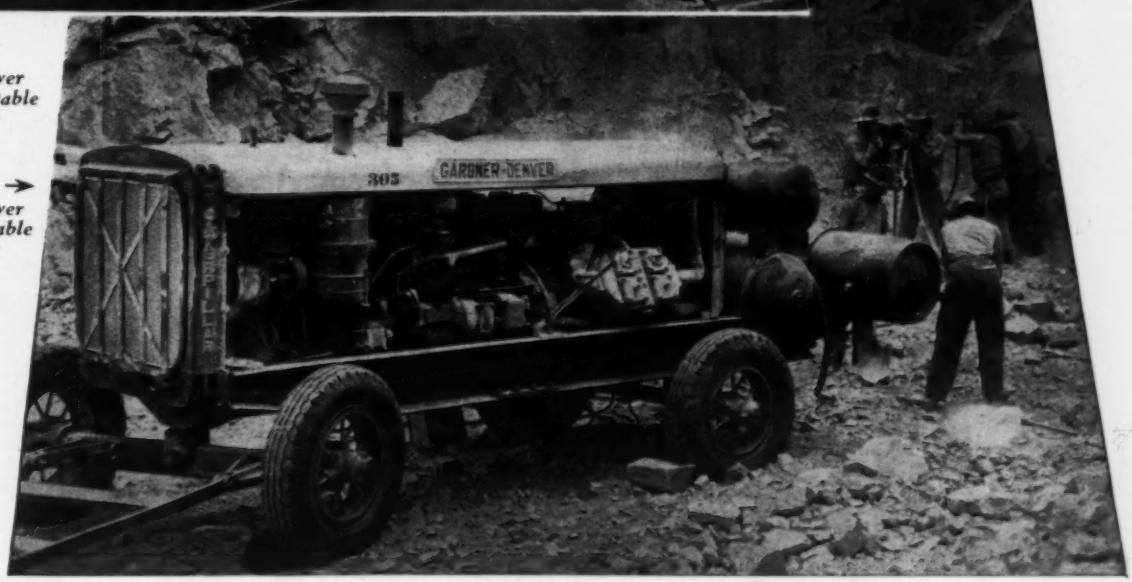

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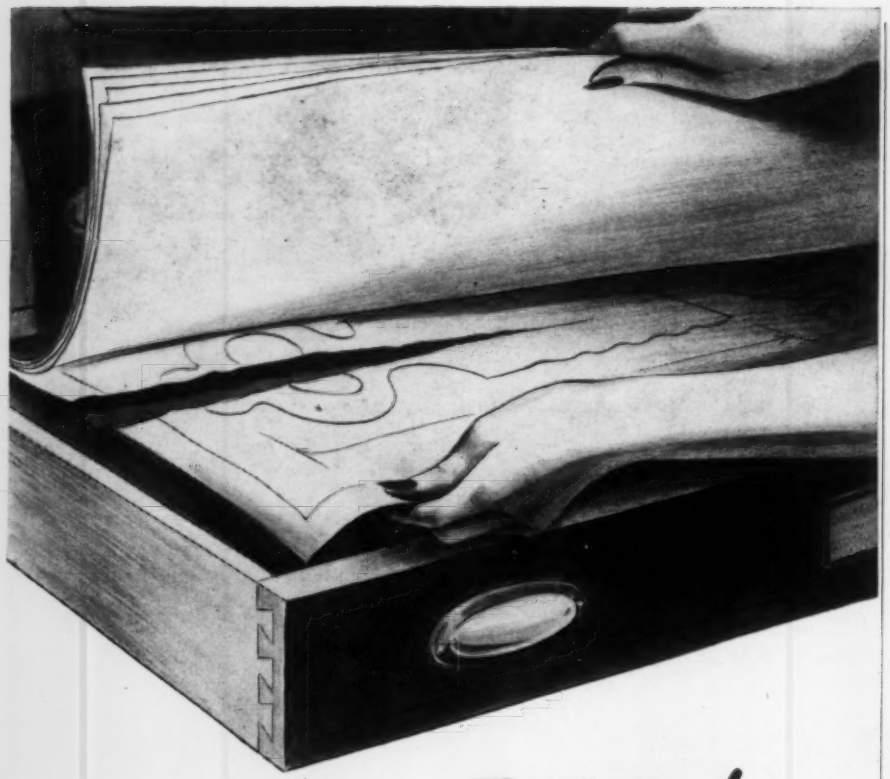

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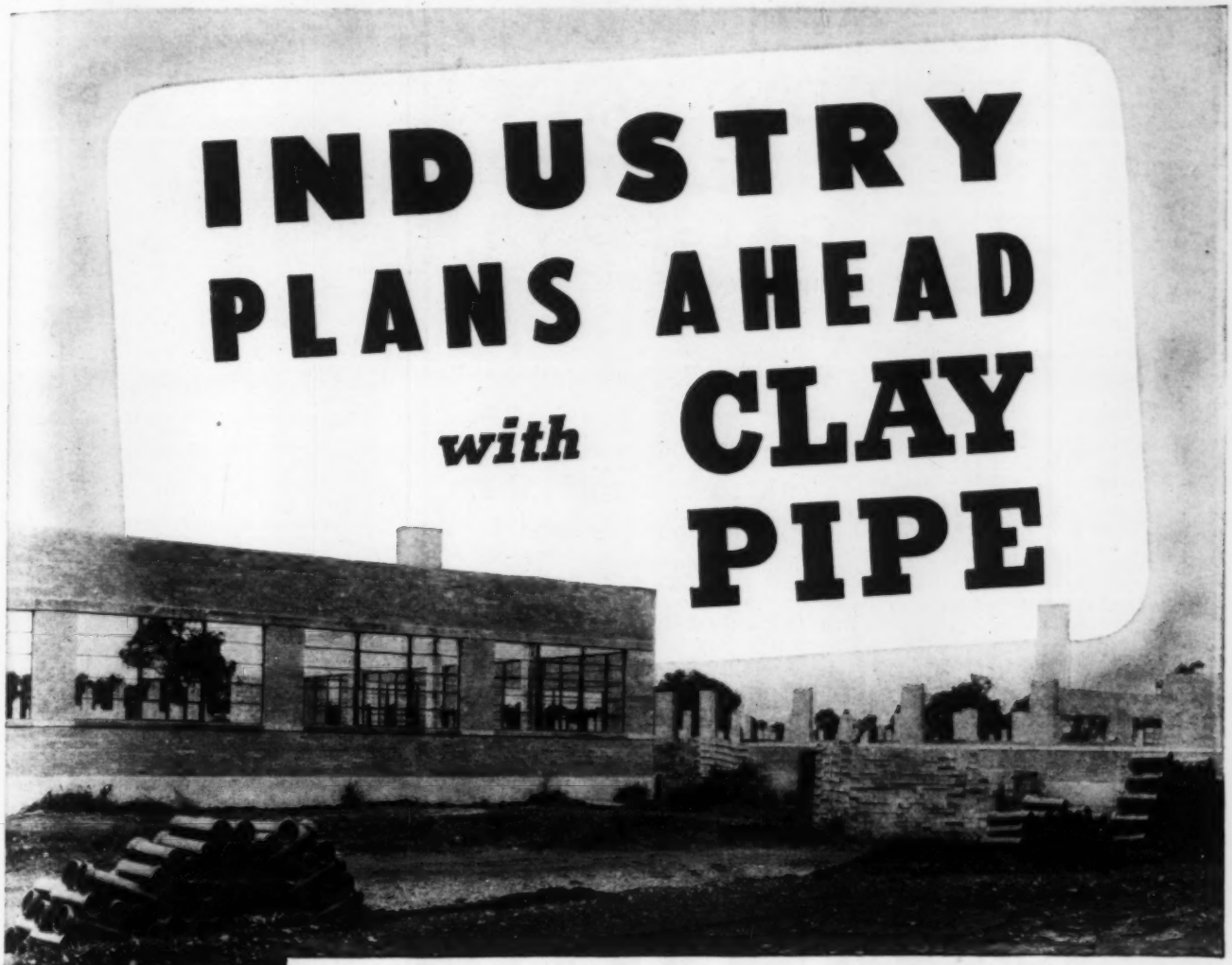

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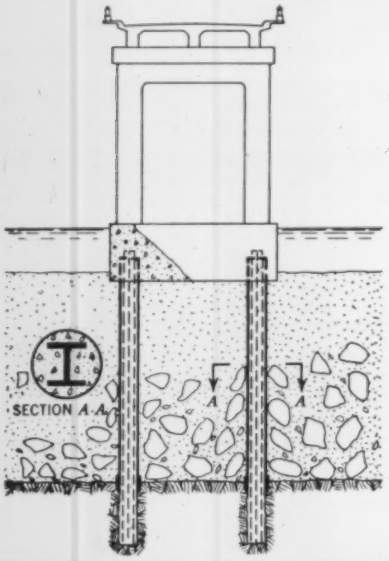

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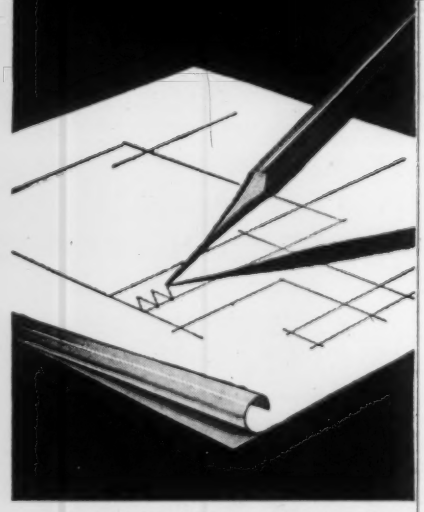

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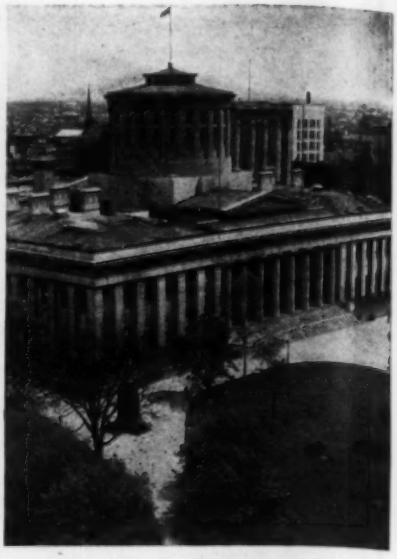

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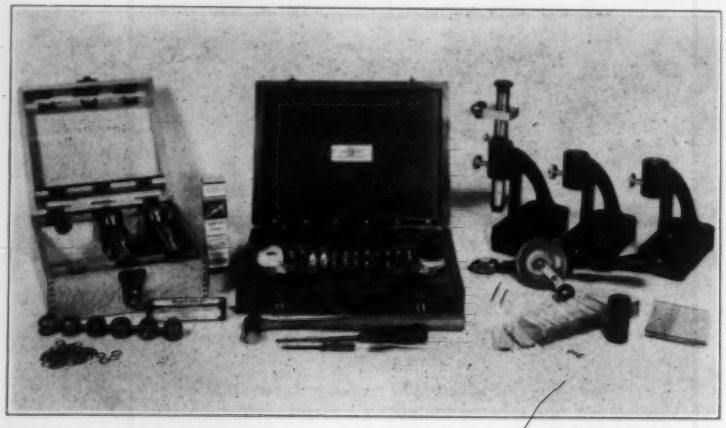

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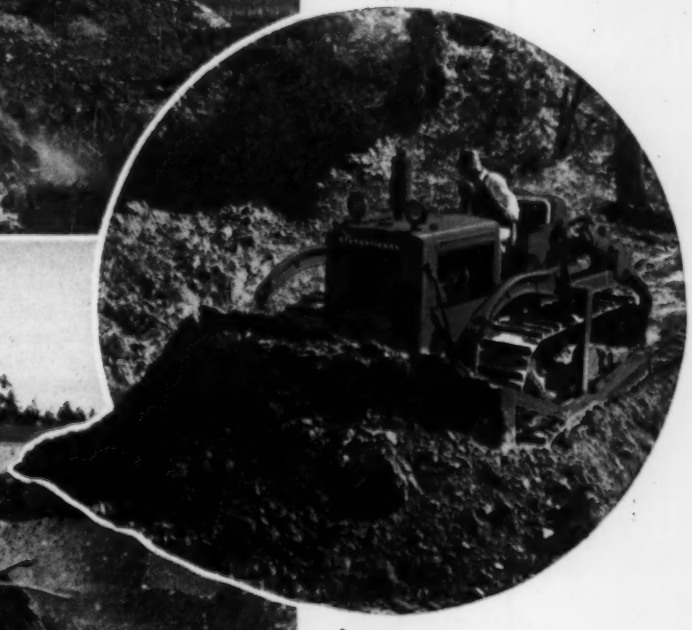

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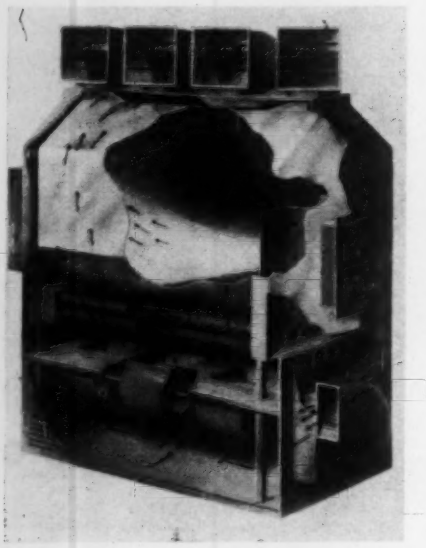

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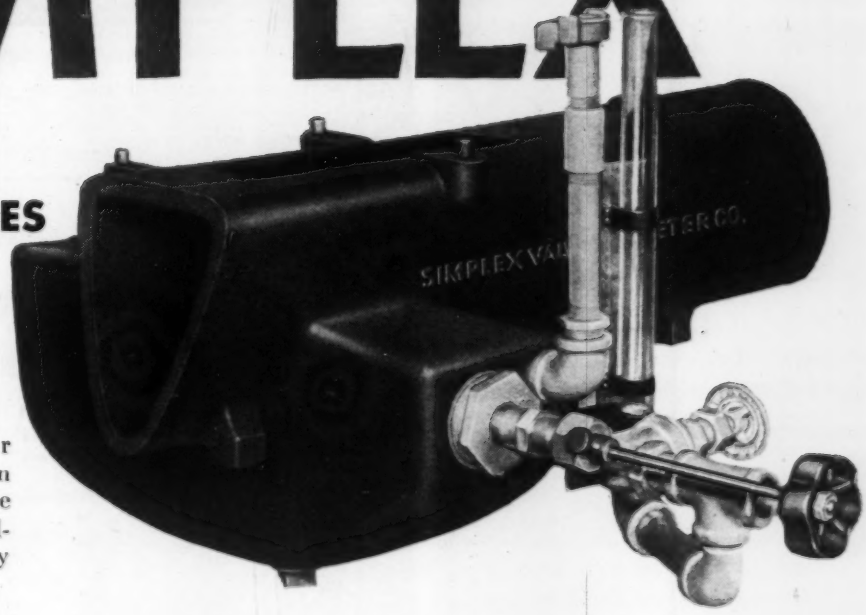

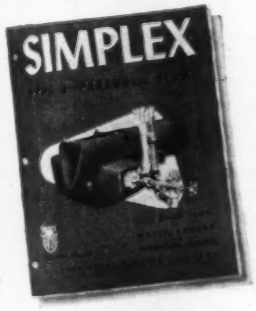

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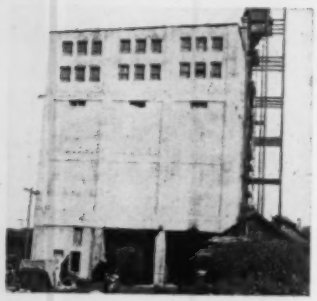

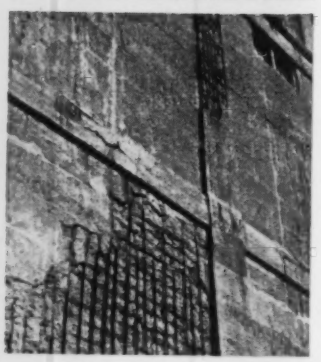

CONCRETE BUILDING REPAIRED WITH "GUNITE"

This concrete structure is the breaker building at Cayuga Rock Salt Company, Myers, N. Y. The concrete was badly disintegrated due to infiltration of salt and resultant action on the reinforcing steel, as evidenced by the lower close-up photo.

The disintegrated concrete was chipped away and the entire area washed and sandblasted. Mesh reinforcement was placed and anchored into place with expansion bolts. Deeply chipped areas were first filled with "GUNITE" and then a 1½" minimum layer of "GUNITE" applied over the entire area. The finished job is shown in the upper photo.

The concrete slab roof of the building was similarly repaired with "GUNITE" on both sides of the slab. Sufficient concrete was first chipped away so that the ultimate reintegrated slab would be the original thickness, thus preventing an increase in the dead load.

"GUNITE" is impervious and will not permit infiltration of salt brine to attack the steel. Its use as armor against sea water and conditions above described is widespread, and its success remarkable.

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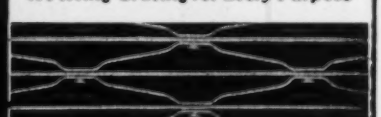

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Scale Drawing Pad

JIFFY SKETCH is the name of a scale drawing pad that is being introduced by Jiffy Sales Co. It enables one to make properly proportioned drawings without use of ruler, drafting board, or T-square, and it may be used in the shop or in the field as easily as in the office.

The Jiffy Sketch pad contains 75 sheets of high-quality tracing tissue, enclosed within a cover jacket that consists of four cardboard flaps. Various scales are printed on three of the flaps. To use the pad, simply fold back the cover flap and then place one of the tissue sheets over the desired scale. The drawing is made to scale with the aid of the printed lines which show through the tissue. The pad measures approximately 9 by 12 in. Sheets are perforated for easy removal. Information on the back of each cover flap includes: basic mechanical drafting standards; electrical, welding, and architectural symbols; decimals of a foot; decimal equivalents of fractions, with circumferences and areas of circles.

Jiffy Sketch will be on sale at most dealers. The price is $1.65 each, or $1.50 each in lots of six or more. One of the pads may be obtained by sending a dollar to Jiffy Sales Co., 1840 East 37th St., Cleveland 14, Ohio.

Four Portable Saw Rigs

FOUR MODELS OF Bearcat portable power saws are now in production by The Paxson Co. of Dowagiac, Mich. Two basic sizes are offered, each supplies in either tilting-top or fixed-top models.

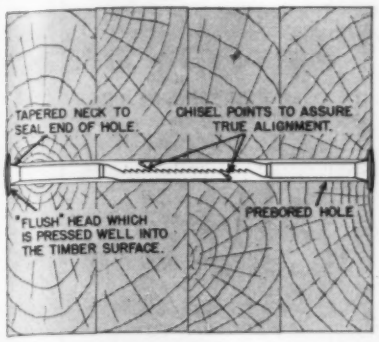
For contractors and builders doing heavy construction work, Bearcat Portable Models XCO (tilting-top) and CO (fixed-top) rip or cut-off stock up to 9 in. thick with saw diameter up to 24 in. These two models require 5 to 20 hp motors or engines. Fabricated steel table-top are 43 by 54 in. on the XCO and CO. For general home building, factory maintenance, crating and cabinet-making, Models XJR (tilting-top) and JR (fixed-top) rip or cut-off stock up to 4 in. thick. These models use motors or engines from 1½ to 8 hp.

All four models offer welded-steel angle frame and top construction with channel steel skids, combining portability from job-to-job with maximum strength and rigidity. The swing cut-off mechanism operates by foot-pressure on a broad pedal, which swings saw through 14 in. horizontally. A special spring idler pulley design maintains even tension on belt and constant power flow to saw arbor. Arbor and idler pulleys are mounted on heavy-duty ball bearings. For ripping stock, a hand wheel locks saw in any position.

The XCO and XJR tilting-top models make a full range of square, angle or bevel cuts up to 45°. Special trunnion pivot on table-top keeps a constant gap between throatboard and saw blade. This enables sawing of narrow pieces when top is tilted. Throat and locks top rigidly at any angle. Details of machines are available on request for manufacturer's Bulletin XD-3 and D-3.

Timber Grips

THE OLIVER TIMBER GRIP, a new device for prolonging the life of railroad ties and for use in laminated timber construction, has been developed by the Oliver Iron and Steel Corporation, Pittsburgh, Pa. This timber grip provides a simple means of preventing ties from opening up or splitting, and also for holding closed any timber already cracked or split.


TAPERED NECK TO SEAL END OF HOLE.
CHISEL POINTS TO ASSURE TRUE ALIGNMENT.
"FLUSH" HEAD WHICH IS PRESSED WELL INTO THE TIMBER SURFACE.
PREBORED HOLE

LAMINATED CONSTRUCTION
TYPICAL INSTALLATION

The grip consists of two interlocking steel members which are inserted from opposite sides of a timber in a prebored hole. Using a squeezing action or hammer blows, the toothed ends of the grip members are caused to engage. The grip will withstand a 5,000 lb pull stress. The head and the swelled shank of the grip provide an effective seal against entrance of moisture. For laminated construction, the grips are used as stitch bolts to hold separate timbers together.

Oliver Timber Grips are made to fit timbers up to 12 in. in width, and larger grips are to be developed. For further details write to Oliver Iron and Steel Corporation, Pittsburgh 3, Pa.

A New 3-Axle Tandem Roller

THE BUFFALO-SPRINGFIELD Roller Co. has announced the development of a new 3-axle tandem roller to be known as the KX-25. After a careful survey of current highway specifications this new model was designed in order to incorporate in one roller all the important features needed to meet the present requirements for compaction equipment.

In keeping with the demands for heavier machines the KX-25 will have an approximate metal weight of 12 tons and a ballasted weight of 18 tons. The wheel base will be shortened to give added maneuverability, while the rolls will be widened to give increased rolling width. All the latest improvements found in the KT model tandems will be incorporated in this new 3-axle machine.

A limited number of the new model, which will be the only 3-axle model produced by Buffalo-Springfield in 1947, will be on the market in time for the current paving season.

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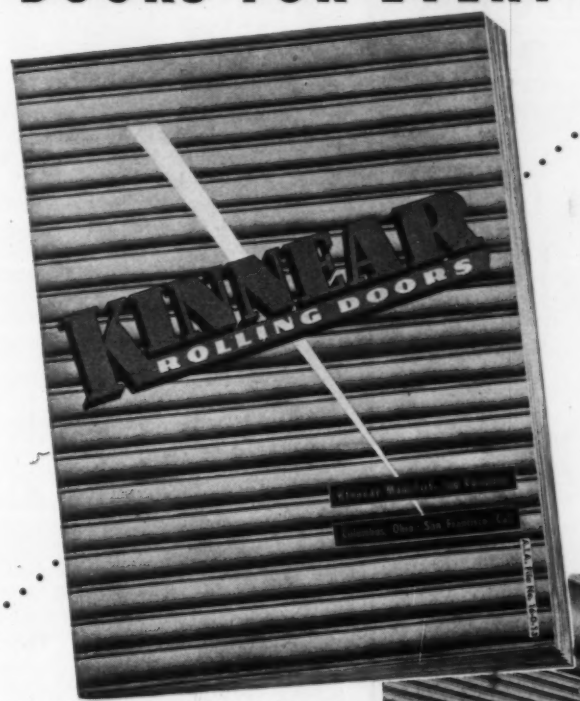
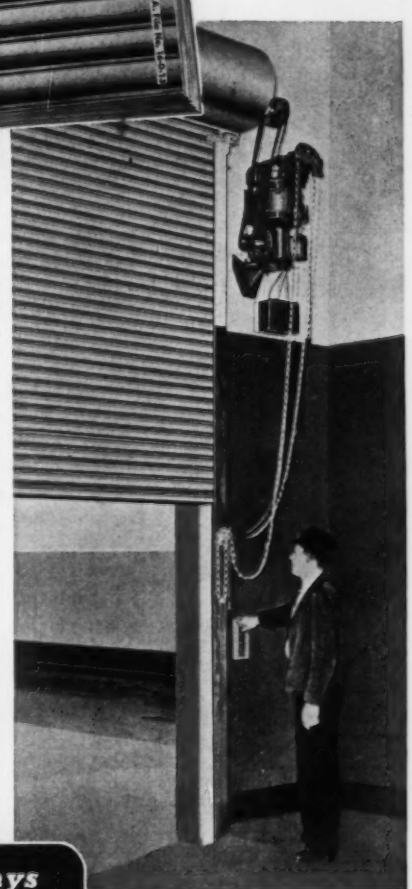
DOORS FOR EVERY NEED





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Literature Available

AIR TOOLS—"Air Tools for Contractors" is the title of a new 24-page 2-color bulletin (Form 5600) released by Ingersoll-Rand. The bulletin is copiously illustrated with photographs showing air tools in action and demonstrating their versatility. A 2-page spread features some of the many uses of the Ingersoll-Rand Impact Wrench and will be of particular interest to contractors. Additional pages are devoted to the various air-operated tools such as sump pumps, tampers, hammers, vibrators, drills, grinders, hoists, and other air tools. A complete line of portable compressors from the small 2-wheel job to the large 500-CFM type is also shown. Address Ingersoll-Rand Company, Phillipsburg, N.J.

ARC WELDING—"Learning to Weld," published by The Lincoln Electric Co., Cleveland, Ohio, 32 pages, $5^1/_2 \times 8^1/_2$ in., 83 illustrations including photos and drawings, bound in good quality paper cover; price postpaid anywhere in U.S.A. 25¢ per copy, elsewhere 35¢ per copy.

GUNITE CONSTRUCTION—A 4-page folder on Gunite Building Construction has been published by the Johnson Western Company of California. It discusses the process of constructing stores, theaters, and medium size buildings with solid reinforced Gunite. It describes, with photographs and drawings, the single wood form employed by the Gunite method, instead of the double form normally used in poured reinforced concrete units. Plain as well as architectural design buildings are illustrated. Write to the Johnson Western Company, Box 6, San Pedro, California.

OIL CIRCUIT BREAKER—The Allis-Chalmers FZO-150 Unitop frame-mounted fabricated, three-pole, high-voltage oil circuit breaker in ratings from 15,000 to 46,000 volts are described in a new illustrated 12-page bulletin, 71B6421, available from Allis-Chalmers Mfg. Co., 704, Milwaukee 1, Wis. It includes outline dimensions with weights and oil volumes for reference. Standard features covered include the Ruptor, pneumatic operation which when used in conjunction with the Ruptor permits 20 cycle reclosing, and an all-fabricated, one-piece rigid top frame.

VERTICAL PUMP—A new 20-page bulletin "Peerless Vertical Close Coupled Turbine Pumps" describes and illustrates the specialized application of Peerless Turbine Pumps. The bulletin is illustrated with cutaway views of the pump, schematic diagrams of suggested methods of pump installation in various services, installation photographs of these pumps, details of pump engineering, construction and operation are also fully described and illustrated. Copies of this bulletin (B-159) may be obtained from the manufacturer, Peerless Pump Division, Food Machinery Corporation, 301 West Avenue 26, Los Angeles 31, California.

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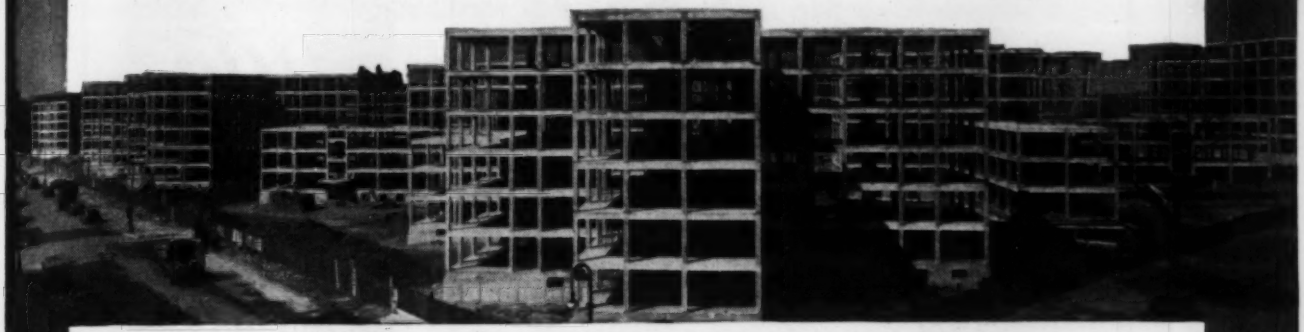

Reinforced concrete frame and floors with wide shallow beams were used for the 27 six-story apartment buildings with three-story wings comprising the Brownsville municipal housing project, Brooklyn, N.Y.

The project, owned and operated by the New York City Housing Authority, includes 1,338 dwelling units to house an estimated 5,175 residents. Frederick G. Frost, architect. Fred N. Severud, engineer.

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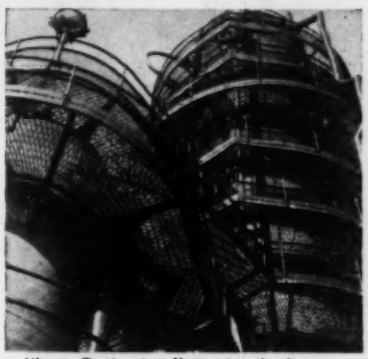

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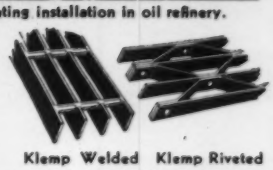

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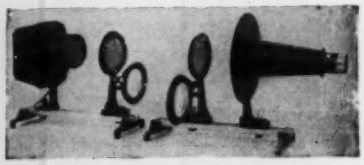

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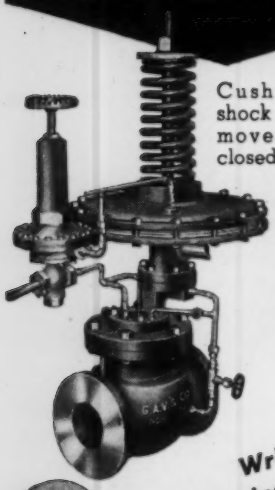

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SURVEYING INSTRUMENTS—A 12-page bulletin (No. 1046) of comprehensive information and prices on transits and levels manufactured by David White Company. The bulletin includes all specifications on the instruments and accessories plus photographs and drawings. Also an extremely detailed book (Catalog 8th Edition) containing 217 pages of information on all types of surveying, building and engineering instruments and accessories. Included in the catalog are the hundreds of office and field equipment items also available through David White Company, such as drafting papers, slide rules, tables, drawing instruments, scientific books and many others. The catalog is book bound and beautifully illustrated with photographs and drawings. Write David White Company, Milwaukee, Wis.

STEREOGRAPH—Pomeroy Stereograph Co., Inc., of Cleveland, Ohio, has just released new literature on its Pomeroy Stereograph Perspective Drawing Instrument. This is the new type of drawing instrument that revolutionizes perspective drawing because it draws perspectives accurately in approximately half the time required by other methods. The folder describes the complete operation of the machine showing how it produces perspectives to hair-line accuracy without vanishing points, grids, outriggings or other cumbersome accessories. It enables the object to be viewed from any desired degree or angle, and from any distance. It illustrates the ease with which the machine draws horizontal and vertical elipses, contours and straight line projections. Also the time required to draw these perspectives on the Pomeroy Stereograph is compared with ordinary, slower methods. The complete instrument is shown in large size together with details of construction. Those who use or draw perspectives will find this folder extremely interesting. Copies are available free upon request to Pomeroy Stereograph Co., Inc., 319 Ferguson Building, Cleveland 14, Ohio.

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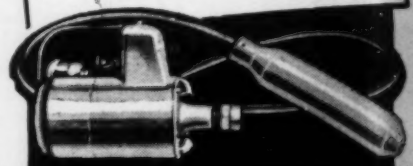

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